COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES & ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRNOMENTAL PROTECTION
DIVISION OF WATER

APPLICATION FOR PERMIT TO CONSTRUCT ACROSS OR ALONG A STREAM AND / OR WATER QUALITY CERTIFICATION

Chapter 151 of the Kentucky Revised Statutes requires approval from the Division of Water prior to any construction or other activity in or along a stream that could in any way obstruct flood flows or adversely impact water quality. *If the project involves work in a stream, such as bank stabilization, dredging or relocation, you will also need to obtain a 401 Water Quality Certification (WQC) from the Division of Water.* This completed form will be forwarded to the Water Quality Branch for WQC processing. The project may not start until all necessary approvals are received from the KDOW. For questions concerning the WQC process, contact John Dovak at 502/564-3410.

If the project will disturb more than 1 acre of soil, you will also need to complete the attached Notice of Intent for Storm Water Discharges, and return both forms to the Floodplain management Section of the KDOW. This general permit will require you to create an implement an erosion control plan for the project.

1. **OWNER:** City of Owensboro; Joe Schepers, PE, SE; City Engineer 19226A
   Give name of person(s), company, governmental unit, or other owner of proposed project.
   MAILING ADDRESS: P.O. Box 10003 / Owensboro, KY 42302-9003
   PhONE #: 270-687-8646 **EMAIL:** schepersjg@owensboro.org
2. **AGENT:** R. David Weaver, PE, PLS / Bryant Engineering, Inc.
   Give name of person(s) submitting application, if other than owner.
   ADDRESS: 4215 Benttree Drive
   Owensboro, KY 42304
   TELEPHONE #: (270) 685-2811 **EMAIL:** david.weaver@bryant-eng.com
3. **ENGINEER:** R. David Weaver, PE, PLS **P.E. NUMBER:** 19178
   Contact Division of Water if waiver can be granted.
   TELEPHONE #: (270)685-2811 **EMAIL:** @bryant-eng.com
4. **DESCRIPTION OF CONSTRUCTION:** A detailed description is provided in the the project overview section. In general the project will involve ditch improvements on Harsh Ditch and retention basins. The projects has two primary goals: 1.) To lower the water surface profile so that all roadways are passable in the 25-yr event by emergency vehicles. 2.) To improve the infrastructure to allow for future combined sewer separation projects.
5. **COUNTY:** Daviess County **NEAREST COMMUNITY:** City of Owensboro
6. **USGS QUAD NAME** Owensboro East & Sutherland **LATITUDE/LONGITUDE:** N 37-44-31 / W 87-06-14
7. **STREAM NAME:** Harsh Ditch **WATERSHED SIZE (in acres):** 1,971
8. **LINEAR FEET OF STREAM IMPACTED:** N/A
9. **DIRECTIONS TO SITE:** The project can be accessed by taking the north bound exit ramp from the US 60 Bypass onto KY 2155 and traveling north on KY 2155 to the intersection of KY 2155 and E. 25th. Turn left onto E 25th Street and left onto Veach Road.
10. **IS ANY PORTION OF THE REQUESTED PROJECT NOW COMPLETE?** Yes X No If yes, identify the completed portion on the drawings you submit and indicate the date activity was completed. DATE:
11. **ESTIMATED BEGIN CONSTRUCTION DATE:** June 2009
12. **ESTIMATED END CONSTRUCTION DATE:** December 2011
13. **HAS A PERMIT BEEN RECEIVED FROM THE US ARMY, CORPS of ENGINEERS?** Yes X No If yes, attach a copy of that permit.

14. **THE APPLICANT *MUST* ADDRESS PUBLIC NOTICE:**

(a) PUBLIC NOTICE HAS BEEN GIVEN FOR THIS PROPOSAL BY THE FOLLOWING MEANS:

__X__ **Public notice in newspaper having greatest circulation in area** (provide newspaper clipping or affidavit)

____ **Adjacent property owner(s) affidavits** (Contact Division of Water for requirements.)

(b) ____ **I REQUEST WAIVER OF PUBLIC NOTICE BECAUSE:**

_____

Contact Division of Water for requirements.

15. **I HAVE CONTACTED THE FOLLOWING CITY OR COUNTY OFFICIALS CONCERNING THIS PROJECT:**

City Engineer and Floodplain Administrator

Give name and title of person(s) contacted and provide copy of any approval city or county may have issued.

16. **LIST OF ATTACHMENTS:** _____

List plans, profiles, or other drawings and data submitted. Attach a copy of a 7.5 minute USGS topographic map clearly showing the project location.

Public Notice, Project Overview, USGS Map, Current FIRM, Pending FIRM, Construction Drawings, Photographs, Hydraulic Model, & Corp Permit Application

17. **I,** _____ **(owner) CERTIFY THAT THE OWNER OWNS OR HAS EASEMENT RIGHTS ON ALL PROPERTY ON WHICH THIS PROJECT WILL BE LOCATED OR ON WHICH RELATED CONSTRUCTION WILL OCCUR** (for dams, this includes the area that would be impounded during the design flood).

18. **REMARKS:** The City of Owensboro is in the process of acquiring all of the required easements. As per phone conversation on 02/18/09 with Julia Harrod, the application is being submitted in advance of all of the easements being acquired.

I hereby request approval for construction across or along a stream as described in this application and any accompanying documents. To the best of my knowledge, all the information provided is true and correct.

SIGNATURE: Joseph D Schepers

Owner or Agent sign here. (If signed by Agent, a Power of Attorney should be attached.)

DATE: 2/19/09

SIGNATURE OF LOCAL FLOODPLAIN COORDINATOR:

Jim Nicholl

Permit application will be returned to applicant if not properly endorsed by the local floodplain coordinator.

DATE: 2-19-09

SUBMIT APPLICATION AND ATTACHMENTS TO:

Floodplain Management Section
Division of Water
14 Reilly Road
Frankfort, KY 40601

HARSH DITCH PHASE II
DRAINAGE IMPROVEMENTS &
COMBINED SEWER SEPERATION

KY DIVISION OF WATER
PERMIT APPLICATION

Prepared for:
City of Owensboro
Joe Schepers, PE, SE
City Engineer
PO Box 10003
Owensboro, KY 42302-9003

Prepared by:

BRYANT ENGINEERING, INC.
4215 BENTTREE DRIVE•P.O. BOX 21382•OWENSBORO, KY 42304
PHONE: (270)685-2811 FAX: (270)683-4991

PUBLIC NOTICE

AFFIDAVIT OF PUBLICATION

Allison Bates of Owensboro, Kentucky being first duly sworn, says that she is the Classified Supervisor of the Owensboro Messenger-Inquirer, Inc. a newspaper printed and published in the State of Kentucky, County of Daviess, and that the advertisement is a true copy which has been published in the Messenger-Inquirer on the following dates, viz: February 23rd, February 24th, February 25th, 2009

Allison Bates

Allison Bates

Subscribed and sworn to before me, a Notary Public within and for the State and County aforesaid, by Allison Bates to me personally known, this 26th of February, 2009. My commission expires the 24th day of September 2011.

Sally E. Harris

Sally E. Harris

County of Daviess
Notary Public State of Kentucky

PUBLIC NOTICE

Notice is hereby given that the City of Owensboro, P.O. Box 10003; Owensboro, KY 42302-9003, has filed an application with the Natural Resources and Environmental Protection Cabinet to make drainage improvements on Harsh Ditch from Veach Road to KY 2155. Improvements to include retention basins and channel improvements. The project is located in the City of Owensboro, beginning at the intersection of Veach Road and Harsh Ditch, 0.3 miles north of the US 60 Bypass as measured along Veach Road, and terminating at KY 2155, 1.5 miles north of the US 60 Bypass as measured along KY 2155. Any comments or objections concerning this application shall be directed to: Kentucky Division of Water, Water Resources Branch, 14 Reilly Road, Frankfort Office Park, Frankfort, KY 40601. Phone: (502)564-3410.

PUBLIC NOTICE

Notice is hereby given that the City of Owensboro, P.O. Box 10003; Owensboro, KY 42302-9003, has filed an application with the Natural Resources and Environmental Protection Cabinet to make drainage improvements on Harsh Ditch from Veach Road to KY 2155. Improvements to include retention basins and channel improvements. The project is located in the City of Owensboro, beginning at the intersection of Veach Road and Harsh Ditch, 0.3 miles north of the US 60 Bypass as measured along Veach Road, and terminating at KY 2155, 1:5 miles north of the US 60 Bypass as measured along KY 2155. Any comments or objections concerning this application shall be directed to: Kentucky Division of Water, Water Resources Branch, 14 Reilly Road, Frankfort Office Park, Frankfort, KY 40601. Phone: (502)564-3410.

PUBLIC NOTICE

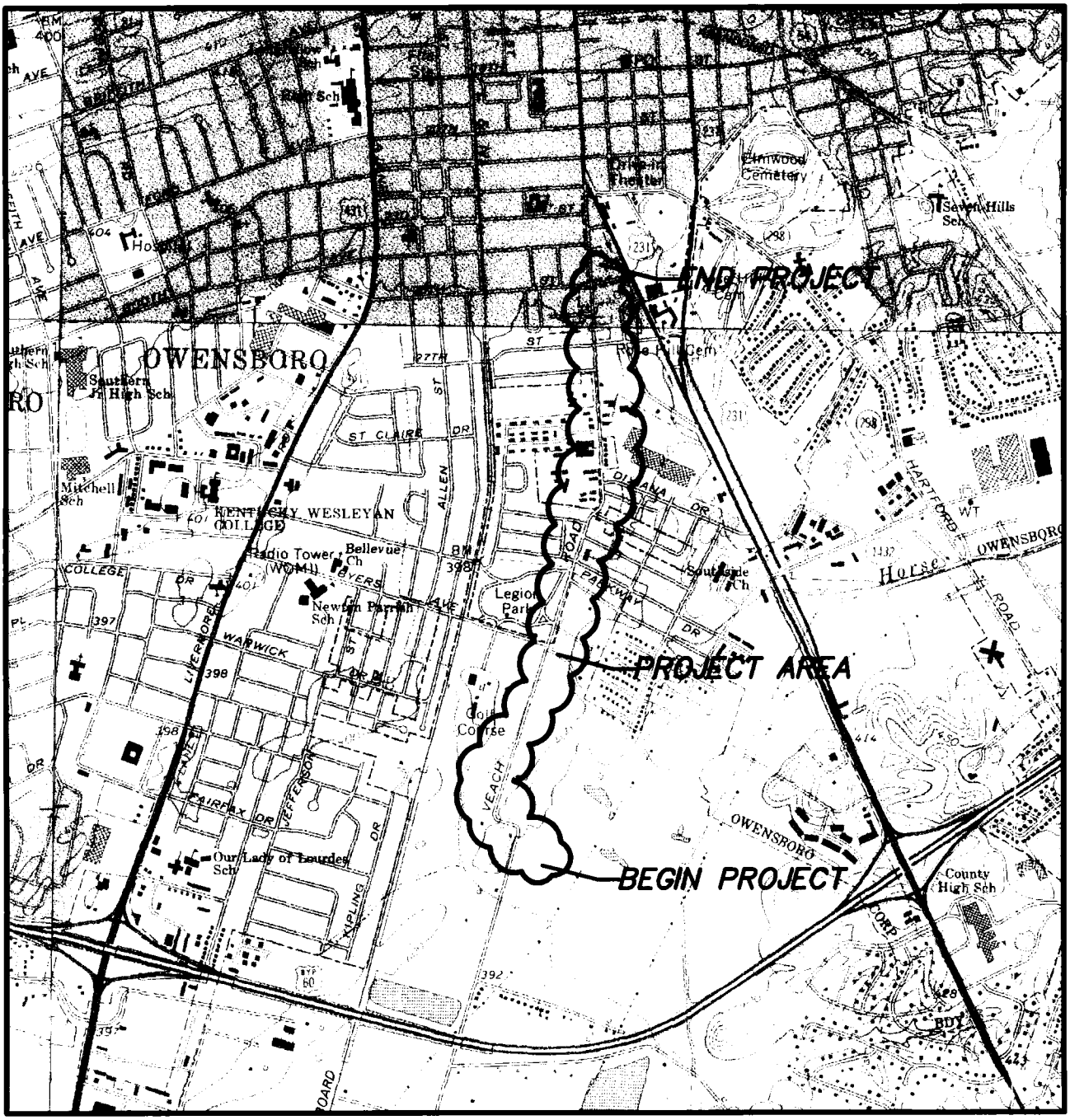
Notice is hereby given that the City of Owensboro, P.O. Box 10003; Owensboro, KY 42302-9003, has filed an application with the Natural Resources and Environmental Protection Cabinet to make drainage improvements on Harsh Ditch from Veach Road to KY 2155. Improvements to include retention basins and channel improvements. The project is located in the City of Owensboro, beginning at the intersection of Veach Road and Harsh Ditch, 0.3 miles north of the US 60 Bypass as measured along Veach Road, and terminating at KY 2155, 1.5 miles north of the US 60 Bypass as measured along KY 2155. Any comments or objections concerning this application shall be directed to: Kentucky Division of Water, Water Resources Branch, 14 Reilly Road, Frankfort Office Park, Frankfort, KY 40601. Phone: (502)564-3410.

PROJECT OVERVIEW

Project Overview

Location / Station Range	Construction Plan Sheets	Photographs #	Summary of Work
Sta. 102+00 ~ 103+00	23	1	Existing bridge to be replaced with a double 10'x6' RCBC with a 8'x6' RCBC. Existing paved ditch on the downstream side to be connected to the proposed RCBC.
Sta. 103+00 ~ 111+50	23-27	2	Existing paved ditch and berm to be removed and existing basin to be enlarged.
Sta. 111+50 ~ 113+00	27	3	Existing double 72"CMP to be replaced with a double 10'x6' RCBC with a 8'x6' RCBC. Existing paved ditches to be connected to proposed structure
Sta. 201+50 ~ 213+00	29-31	4	Existing channel to be raised for safety reasons. By raising the flowline of the existing channel the guardrail along Veach Road can be removed. In addition the existing channel has some near vertical slopes along Veach Road that will be eliminated. The existing channel is partially lined with broken concrete. A double 10'x4' RCBC will be constructed to replace the existing channel.
Sta. 213+00 ~ 218+50	33		The exsiting 54"CMP in the existing channel will be left in place. A double 10'x4' RCBC will be constructed west of the existing structure.
Sta. 218+50 ~ 303+00	33-35	5	The existing paved ditch shall be widened. The existing RCBC under Live Oak Place will remain.
Sta. 303+00 ~ 305+20	35-37		The existing CMPA to be replaced with a double 10'x4' RCBC
Sta. 305+20 ~ 406+00	37 & 53		The existing CMPA to be replaced with a paved ditch and a dry retention basin.
Sta. 406+00 ~ 418+50	37-41		The existing CMPA to be replaced with a double 10'x4' RCBC
Sta. 418+50 ~ 500+50	41-43 & 54	6	The existing dry retention basin & paved ditch to be replaced with a larger wet basin.
Sta. 500+50 ~ 503+00	43		A double 10'x4' RCBC shall be constructed to connect two proposed wet basins.
Lt Sta. 500+00 ~ 503+00	51	7&8	The old existing channel in this area shall be raised for safety reasons. The City has pulled cars out of this channel on more than one occasion.
Sta. 503+00 ~ 600+50	43-45 & 55	9	The existing channel and dry basin shall be replaced with a wet retention basin.
Sta. 600+50 ~ 601+00	45		The existing CMPA shall be replaced with a 12'x4' RCBC
Sta. 601+00 ~ 609+00	47-49	10	The existing channel shall be widened and paved.
Sta. 609+00 ~ 610+00	49		An additional RCBC barrel shall be constructed north of the existing culvert.

USGS MAPPING FOR THE PROJECT



SCALE: 1"=2000'

PREPARED BY:

BRYANT ENGINEERING INC.

4215 BENTTREE DRIVE
P.O. BOX 21382
OWENSBORO, KENTUCKY 42304

DATE: 2-17-2009

HARSH DITCH (PROJECT AREA)

CITY OF OWENSBORO
DAVIESS COUNTY, KENTUCKY

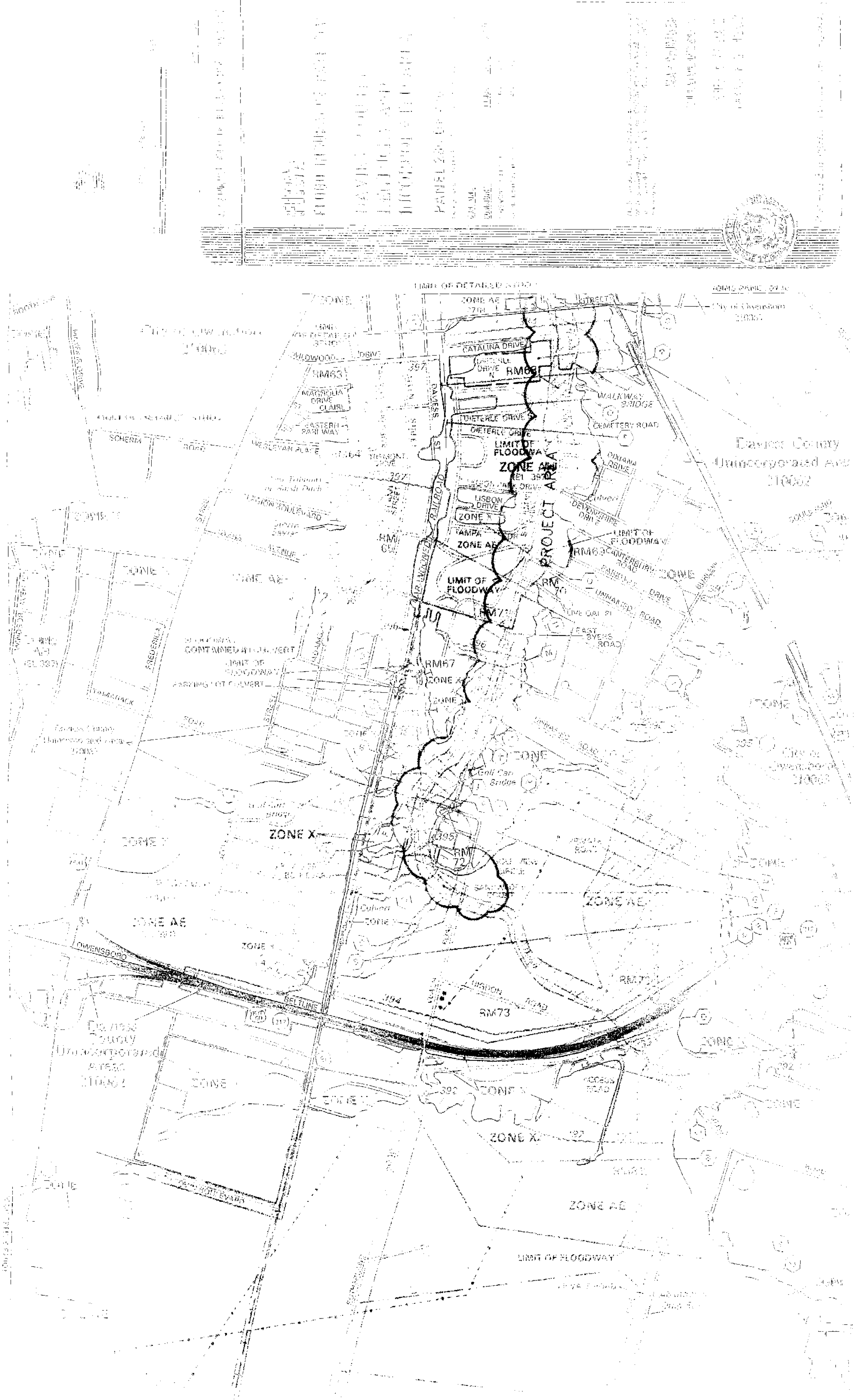
OWENSBORO EAST
AND
SUTHERLAND QUADRANGLE

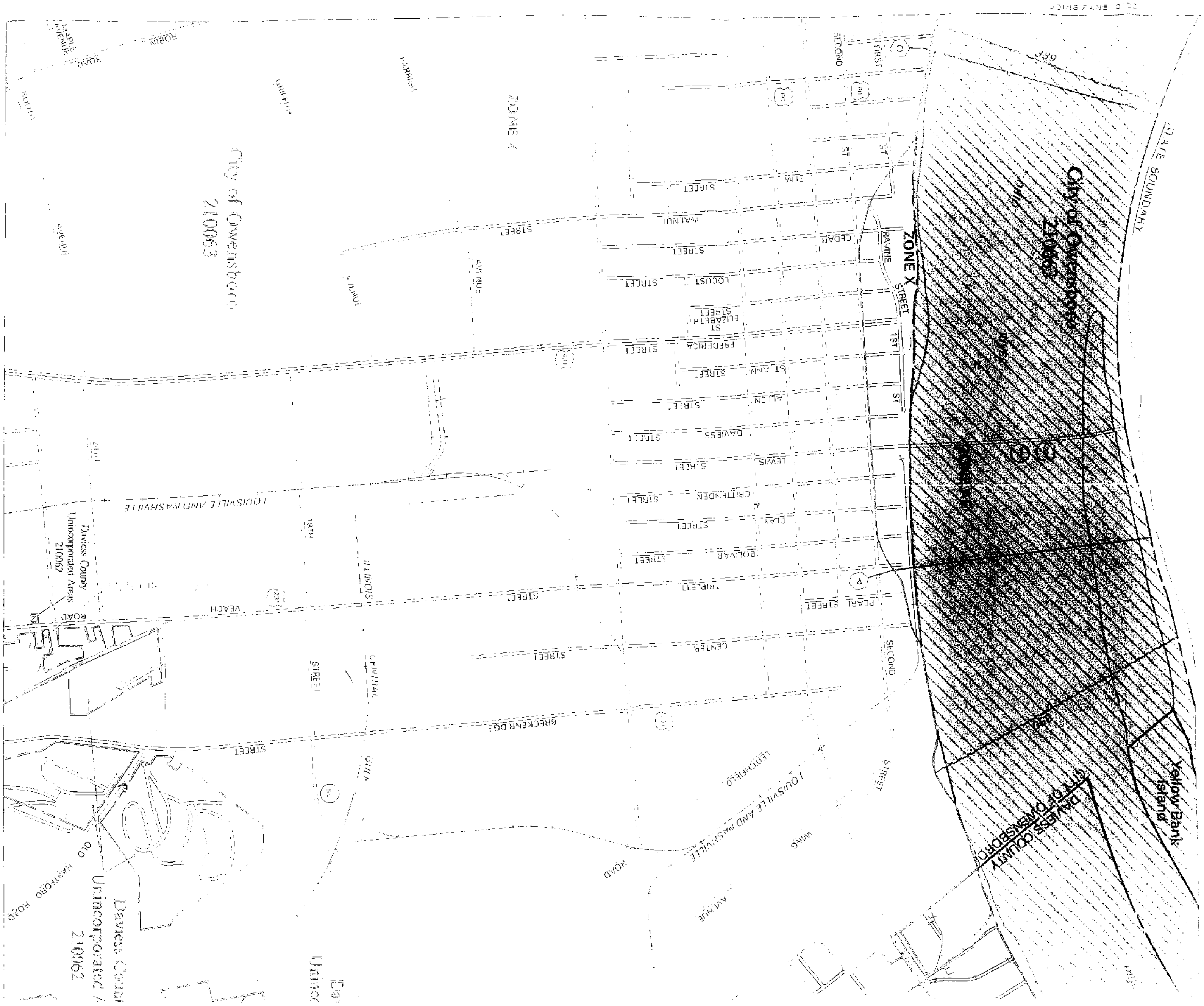
BEGIN: LATITUDE: N 37° 43' 52"
LONGITUDE: W 87° 06' 21"

END: LATITUDE: N 37° 45' 10"
LONGITUDE: W 87° 06' 08"

F:\DATA\2006\06-3968\USGS.dwg

CURRENT FIRM MAPPING FOR THE PROJECT


LIMIT OF DETAILED STUDY
ZONE AE
CATALINA DRIVE
RM63
MAGNOLIA DRIVE
EASTERN PARK WAY
CEMETERY ROAD
WALKWAY BRIDGE
DIETERLE DRIVE
LIMIT OF FLOODWAY
ZONE AE
Daviess County
Unincorporated Areas
210062
LISBON DRIVE
ZONE X
TAMPA
DEVONSHIRE DRIVE
PROJECT AREA
RM69
CANTERBURY ROAD
RAILROAD
RM67
CONTAINED IN CULVERT
PARKING LOT CULVERT
EAST BYERS ROAD
UNNAMED ROAD
Golf Cart Bridge
ZONE X
ZONE AE
OWENSBORO
BELTLINE
RM73
LISBON ROAD
ACCESS ROAD
ZONE X
ZONE AE
LIMIT OF FLOODWAY



APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

DAVIESS COUNTY,
KENTUCKY AND
INCORPORATED AREAS

PANEL 140 OF 430
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
OWENSBORO, CITY OF	[illegible]	[illegible]	[illegible]
UNINCORPORATED AREAS	[illegible]	[illegible]	[illegible]

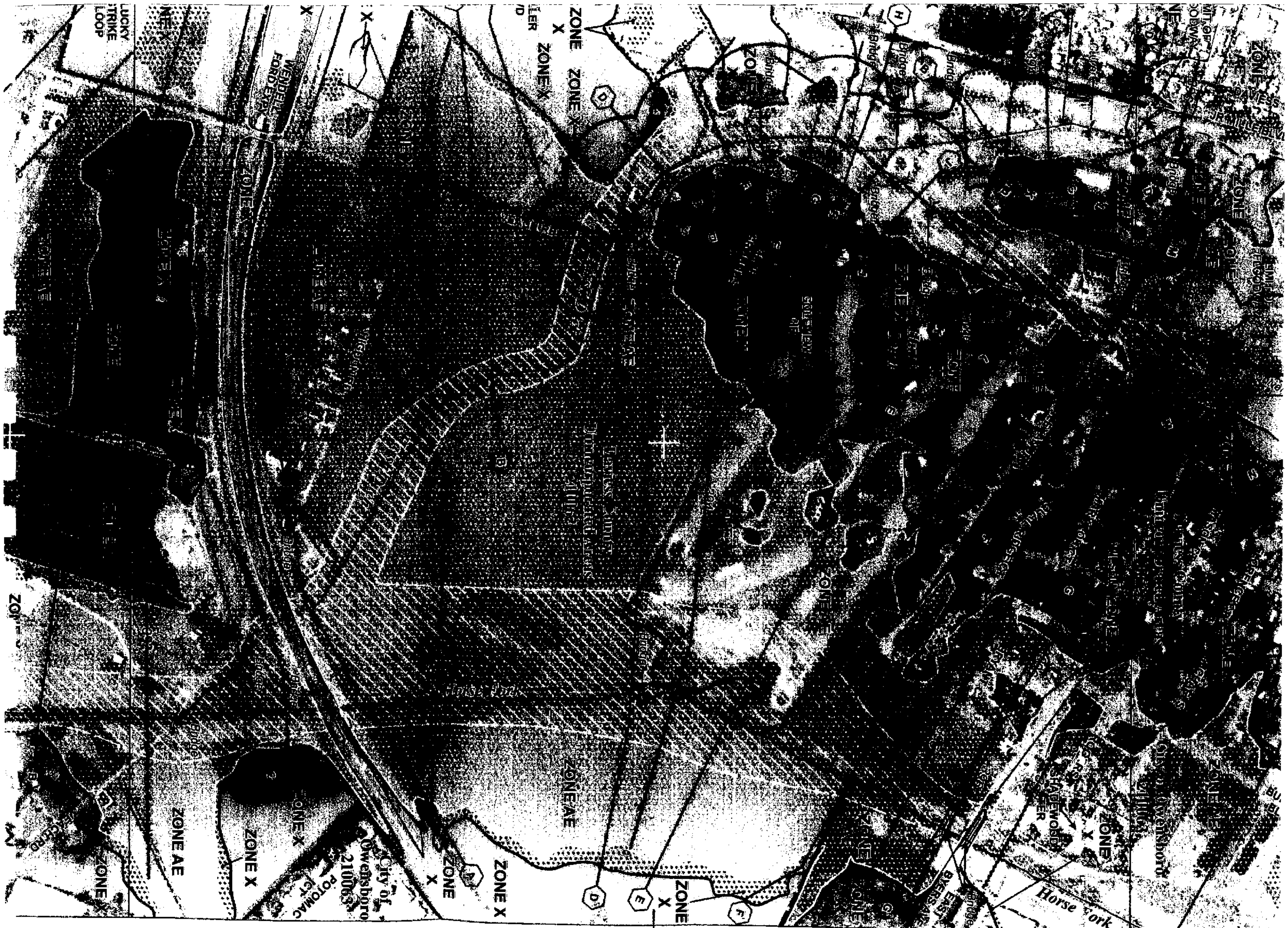
Notice To User: The MAP NUMBER shown below should be used when placing map orders; the COMMUNITY NUMBER shown above should be used on insurance applications for the subject community.

MAP NUMBER
21059C0140 C

EFFECTIVE DATE
MARCH 3, 1997

Federal Emergency Management Agency

PENDING FIRM MAPPING FOR THE PROJECT



JOINS PANEL 0277

$^{41}76^{000m}$N

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0276D

FIRM
FLOOD INSURANCE RATE MAP

DAVIESS COUNTY, KENTUCKY
AND INCORPORATED AREAS

PANEL 276 OF 435
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
Daviess County	210062	0276	D
Owensboro, City of	210063	0276	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
21059C0276D

Kentucky

State of Kentucky
Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0276D

FIRM
FLOOD INSURANCE RATE MAP

DAVIESS COUNTY, KENTUCKY
AND INCORPORATED AREAS

PANEL 276 OF 435
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
Daviess County	210062	0276	D
Owensboro, City of	210063	0276	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
21059C0276D

Kentucky

State of Kentucky
Federal Emergency Management Agency

PANEL 0138D

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

DAVIESS COUNTY, KENTUCKY
AND INCORPORATED AREAS

PANEL 138 OF 435
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
Daviess County	210062	0138	D
Owensboro, City of	210063	0138	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
21059C0138D

Kentucky

State of Kentucky
Federal Emergency Management Agency

REDUCED CONSTRUCTION PLANS

CITY OF OWENSBORO

HARSH DITCH PHASE II

THE FOLLOWING DRAWINGS SHALL BE INCLUDED BY REFERENCE

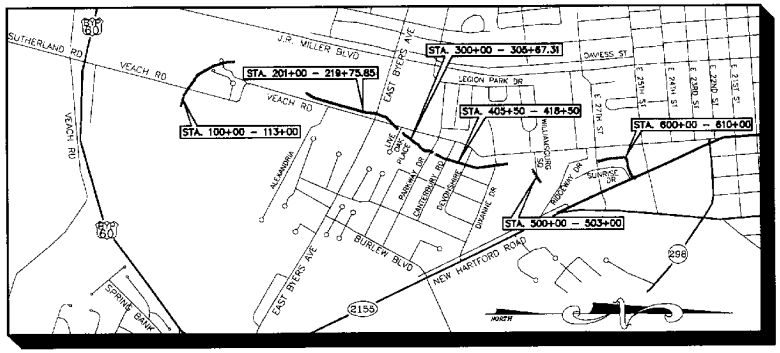
KYTC STANDARD DRAWINGS
RDB-xxx-xx

OMPC PUBLIC IMPROVEMENT SPECIFICATIONS STANDARD DRAWINGS
EXHIBIT NO. X-XX

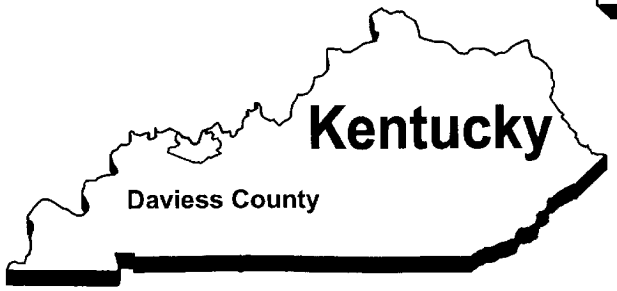
KIA LOAN NO.: _____

OWENSBORO BID NO.: _____

SET NO.: _____



VICINITY MAP
NOT TO SCALE



SHEET INDEX	
SHEET NO.	DESCRIPTION
1	COVER SHEET
2A	GENERAL NOTES
2B	BOX CULVERT NOTES
2C	MAINTENANCE OF TRAFFIC NOTES
2D	EROSION CONTROL NOTES
2E	PROJECT QUANTITIES
2F	SHEET INDEX
3-22	EXIST. TOPOGRAPHIC SURVEY & DEMOLITION PLAN
23-50	MAIN CHANNEL PLAN & PROFILES
51	OLD CHANNEL LEFT OF STA. 400+00 TO 403+00
52-56	RETENTION BASIN PLANS
57-58	ROADWAY IMPROVEMENTS TYPICAL SECTIONS
59-65	ROADWAY IMPROVEMENTS
66-67	STORM SEWER PROFILES
68-80	STURCTURAL DETAILS
81	MISC. DETAILS

REDUCED PLAN SET DO NOT SCALE

CITY OF OWENSBORO
KENTUCKY
COUNTY OF
DAVIESS
PROJECT: HARSH DITCH DRAINAGE IMPROVEMENTS PHASE II

MAYOR
RONALD L. PAYNE
COMMISSIONERS
MAYOR PRO TEM
CHARLIE CASTLEN
JOHN M. KAZLAUSKAS
DAVID JOHNSON
CANDANCE BRAKE

CITY OF OWENSBORO
APPROVED: _____ 20____
CITY ENGINEER

OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

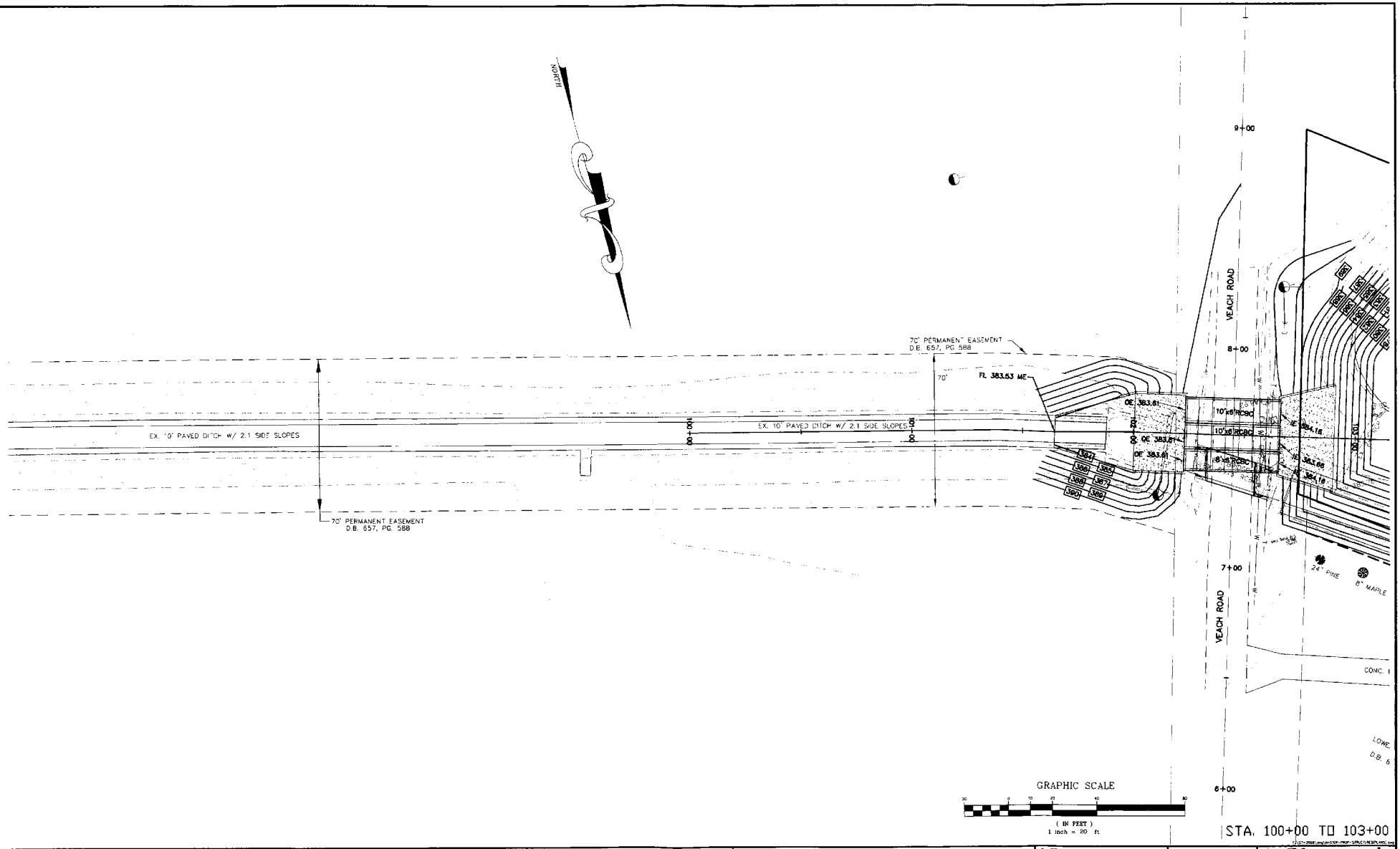
REVISIONS			
NO.	DATE	DESCRIPTION	BY

COVER SHEET

HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: N.T.S.
JOB NO.: 07-3968
SHEET 1 OF 81

BEi BRYANT ENGINEERING INC
Civil Engineering · Land Surveying
270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

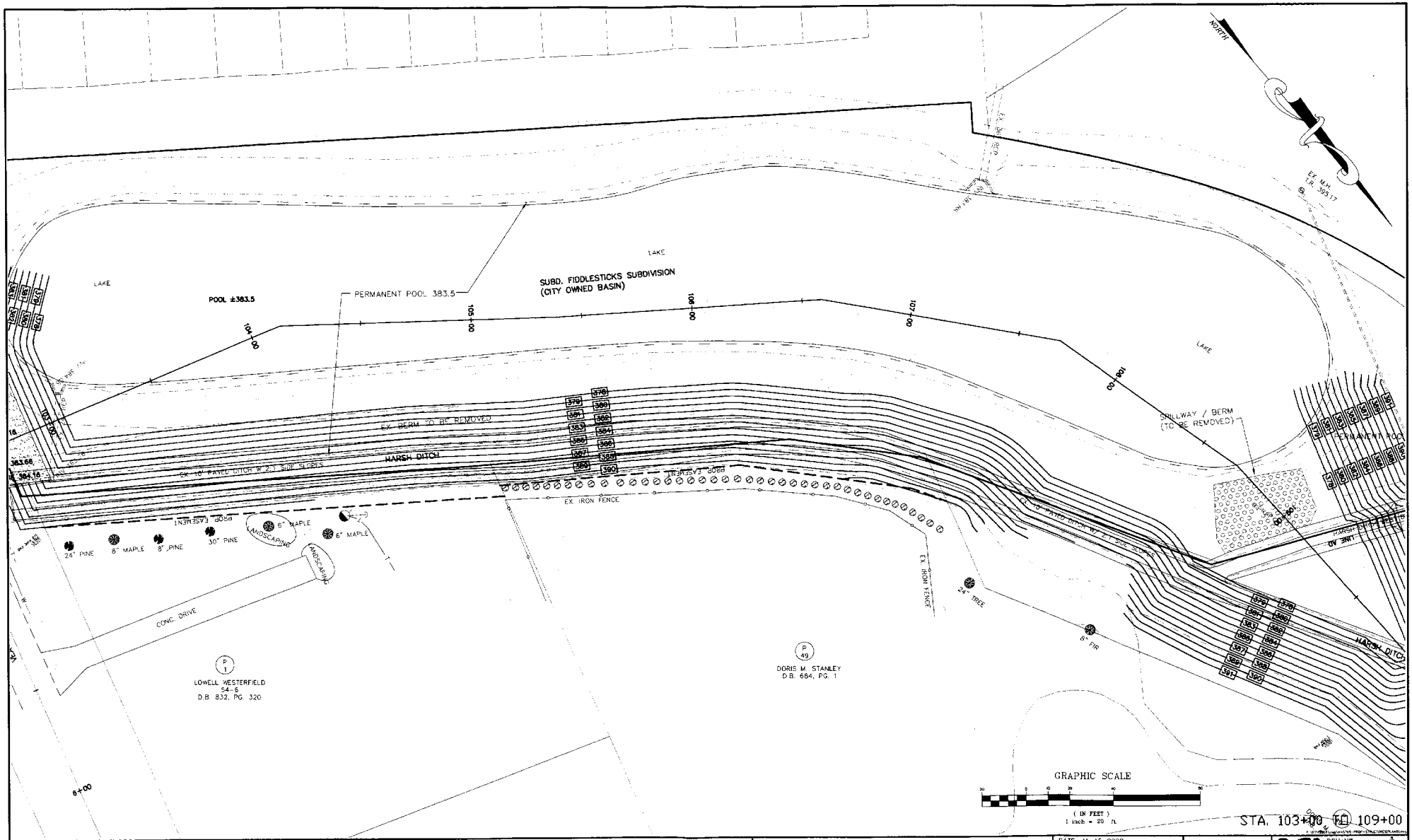
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 23 OF 81

BEI BRYANT ENGINEERING INC.
Civil Engineering - Land Surveying
270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

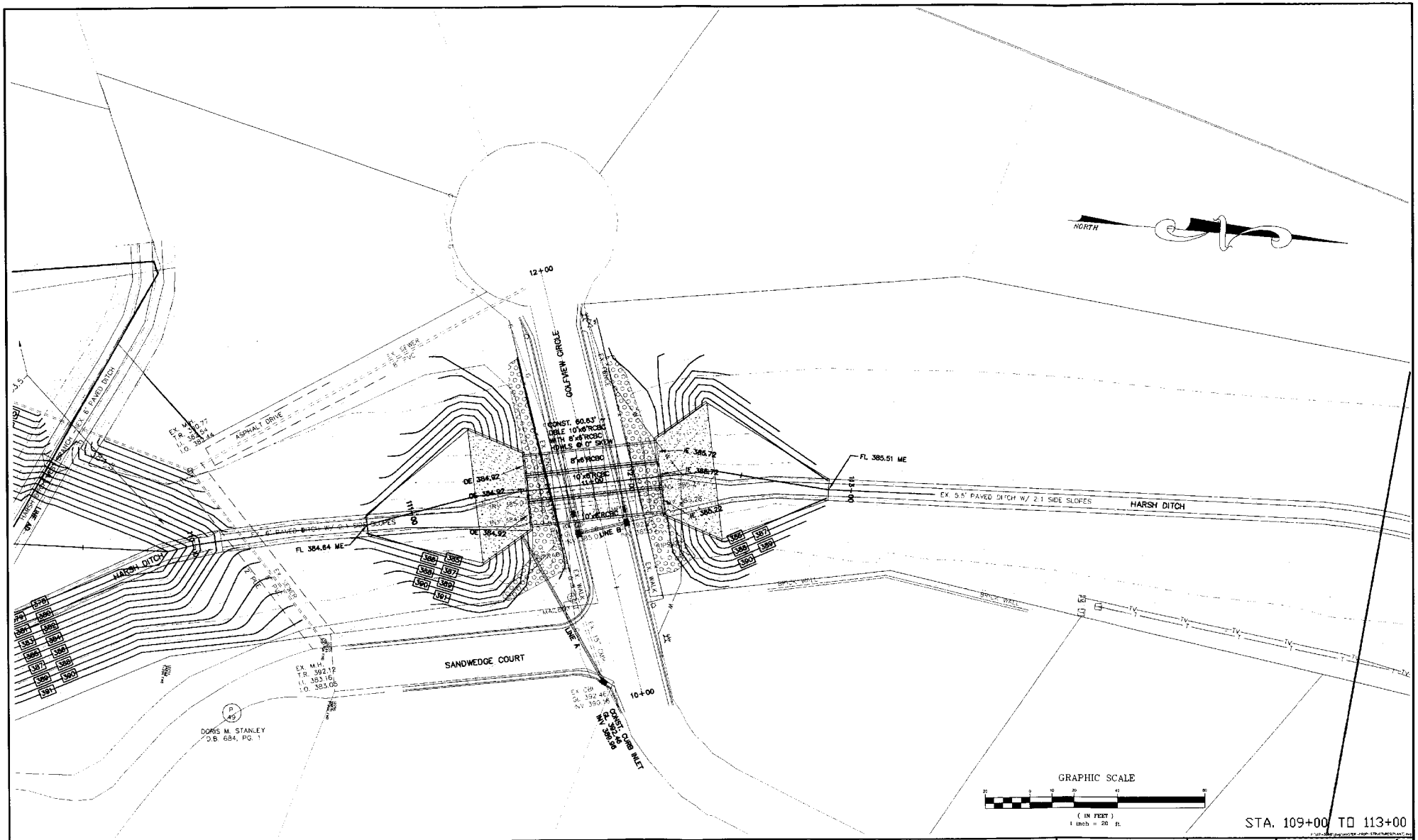
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

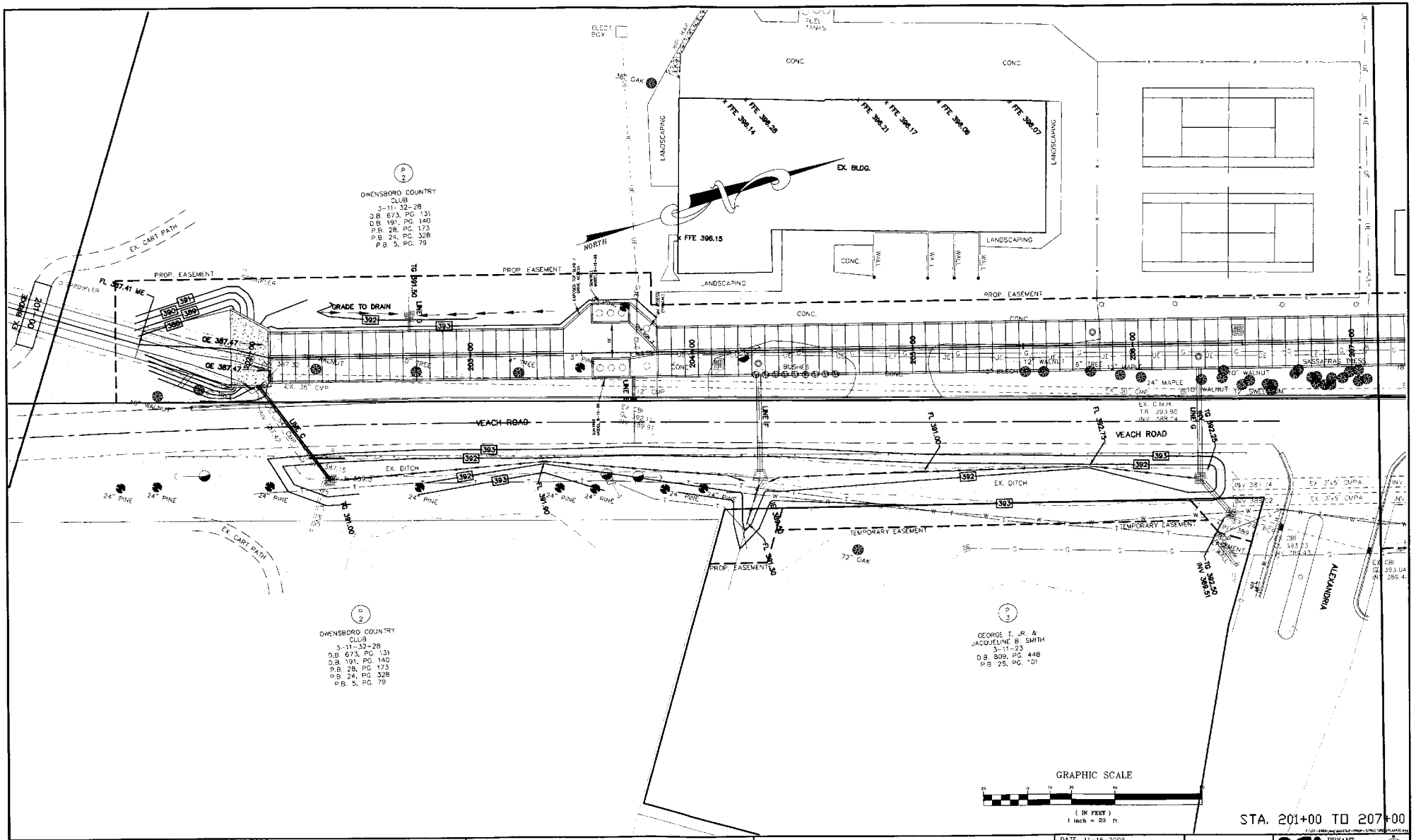
DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 25 OF 81

BEi BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
4215 BENTBRIDGE DRIVE
P.O. BOX 20382
OWENSBORO, KENTUCKY 42304
270-685-3811



OWNER/DEVELOPER **CITY OF OWENSBORO** P.O. BOX 10003 OWENSBORO, KY 42302	REVISIONS NO. DATE DESCRIPTION BY	**PLAN VIEW**	**HARSH DITCH** **OWENSBORO, KENTUCKY** DATE: 11-15-2008 SCALE: 1"=20' JOB NO.: 07-3968 SHEET 27 OF 81

BEi BRYANT ENGINEERING INC.
Civil Engineering - Land Surveying
270-685-2811



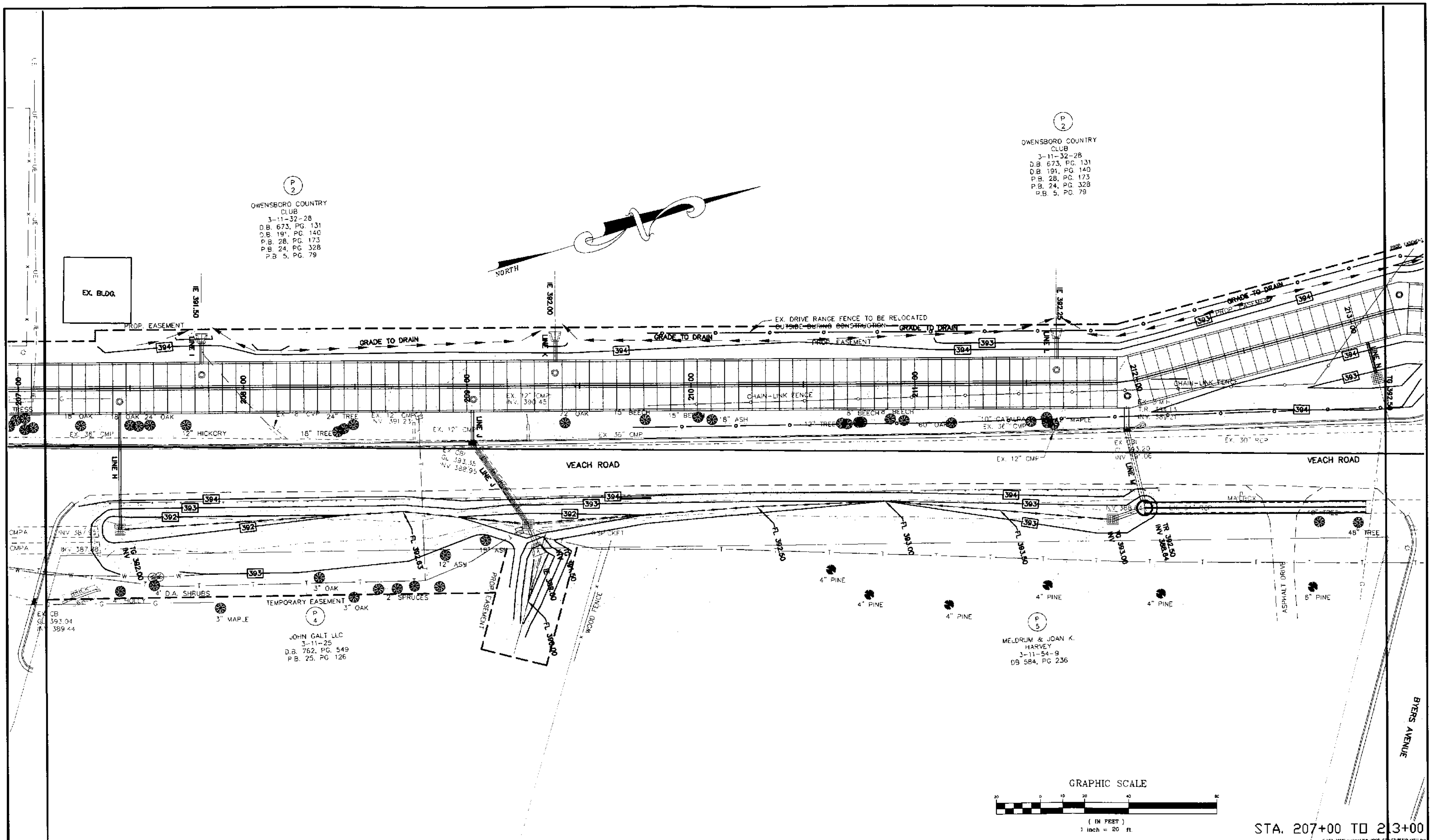
OWNER/DEVELOPER	REVISIONS			
CITY OF OWENSBORO	NO.	DATE	DESCRIPTION	BY
P.O. BOX 10003				
OWENSBORO, KY 42302				

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 29 OF 81

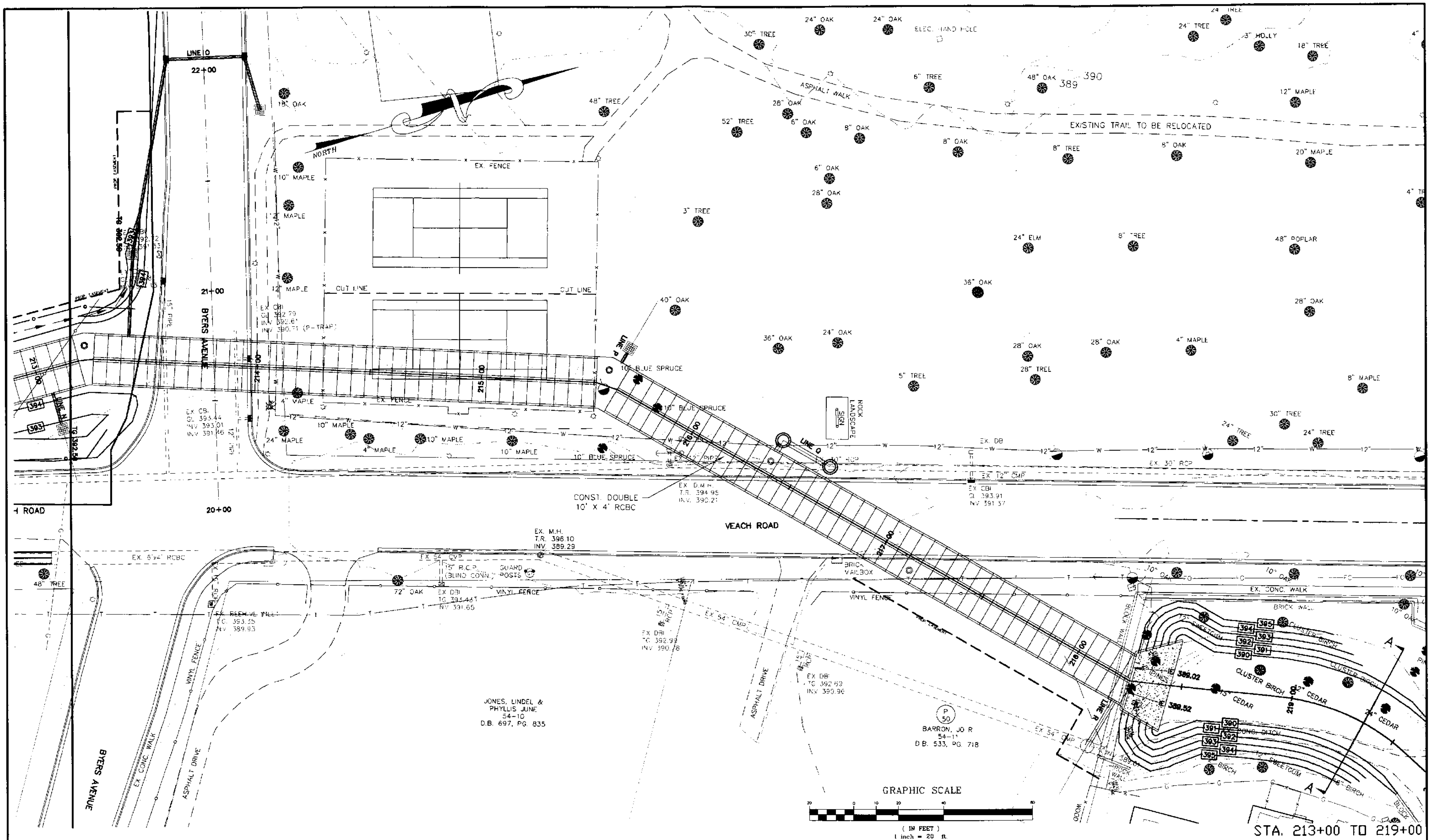
BEi BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-2811



STA. 207+00 TO 213+00

OWNER/DEVELOPER	REVISIONS	PLAN VIEW	HARSH DITCH	DATE: 11-15-2008
CITY OF OWENSBORO P.O. BOX 10003 OWENSBORO, KY 42302	NO. / DATE / DESCRIPTION / BY		OWENSBORO, KENTUCKY	SCALE: 1"=20' JOB NO.: 07-3968 SHEET 31 OF 81

BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

NO.	DATE	DESCRIPTION	BY
REVISIONS			

PLAN VIEW

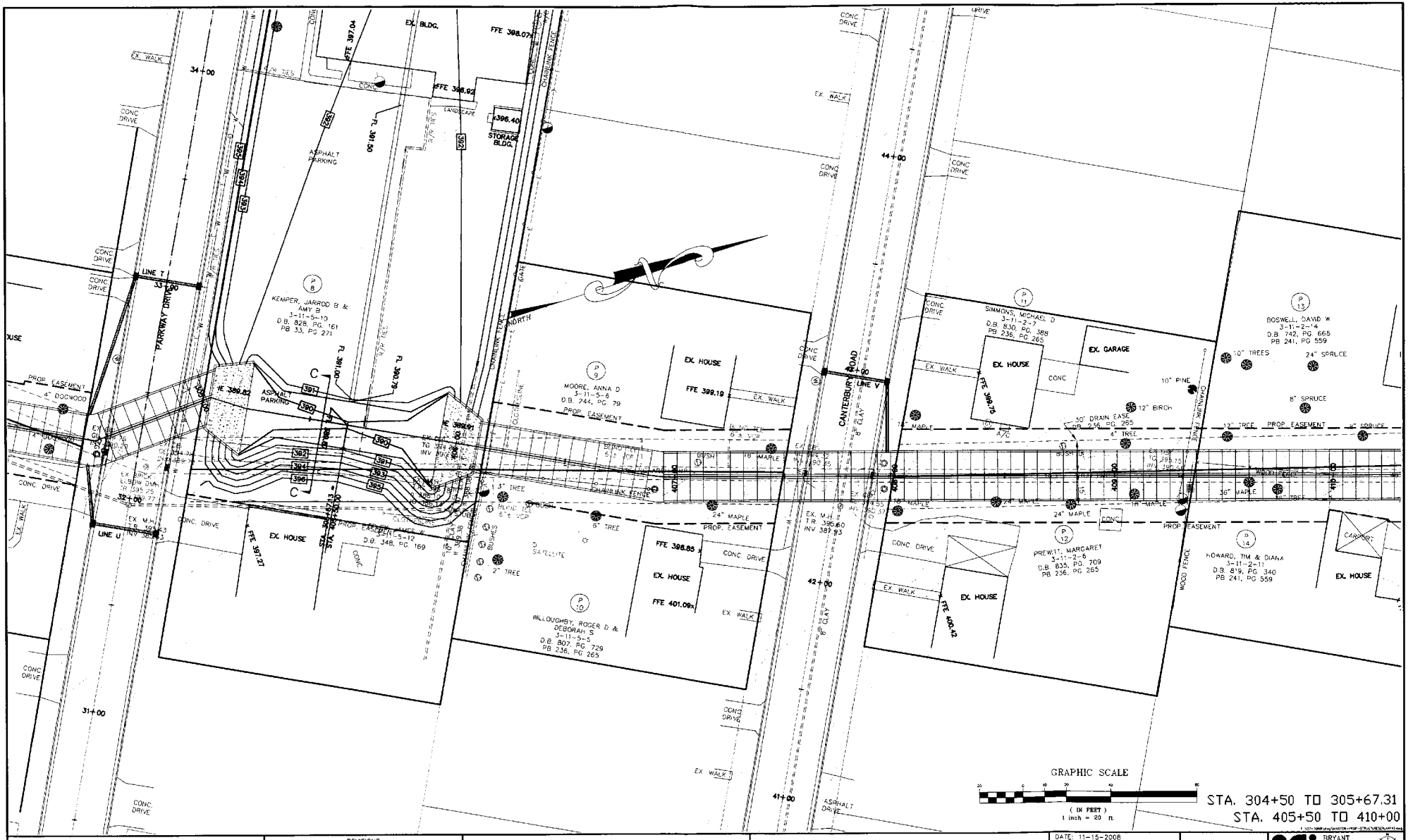
HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 33 OF 81

BEi BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-2811

OWNER/DEVELOPER **CITY OF OWENSBORO** P.O. BOX 10003 OWENSBORO, KY 42302	REVISIONS NO. | DATE | DESCRIPTION | BY	**PLAN VIEW**	**HARSH DITCH** **OWENSBORO, KENTUCKY** DATE: 11-15-2008 SCALE: 1"=20' JOB NO.: 07-3968 SHEET 35 OF 81

BEi BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
4205 BRECKINRIDGE DRIVE
P.O. BOX 21302
OWENSBORO, KENTUCKY 42304
270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

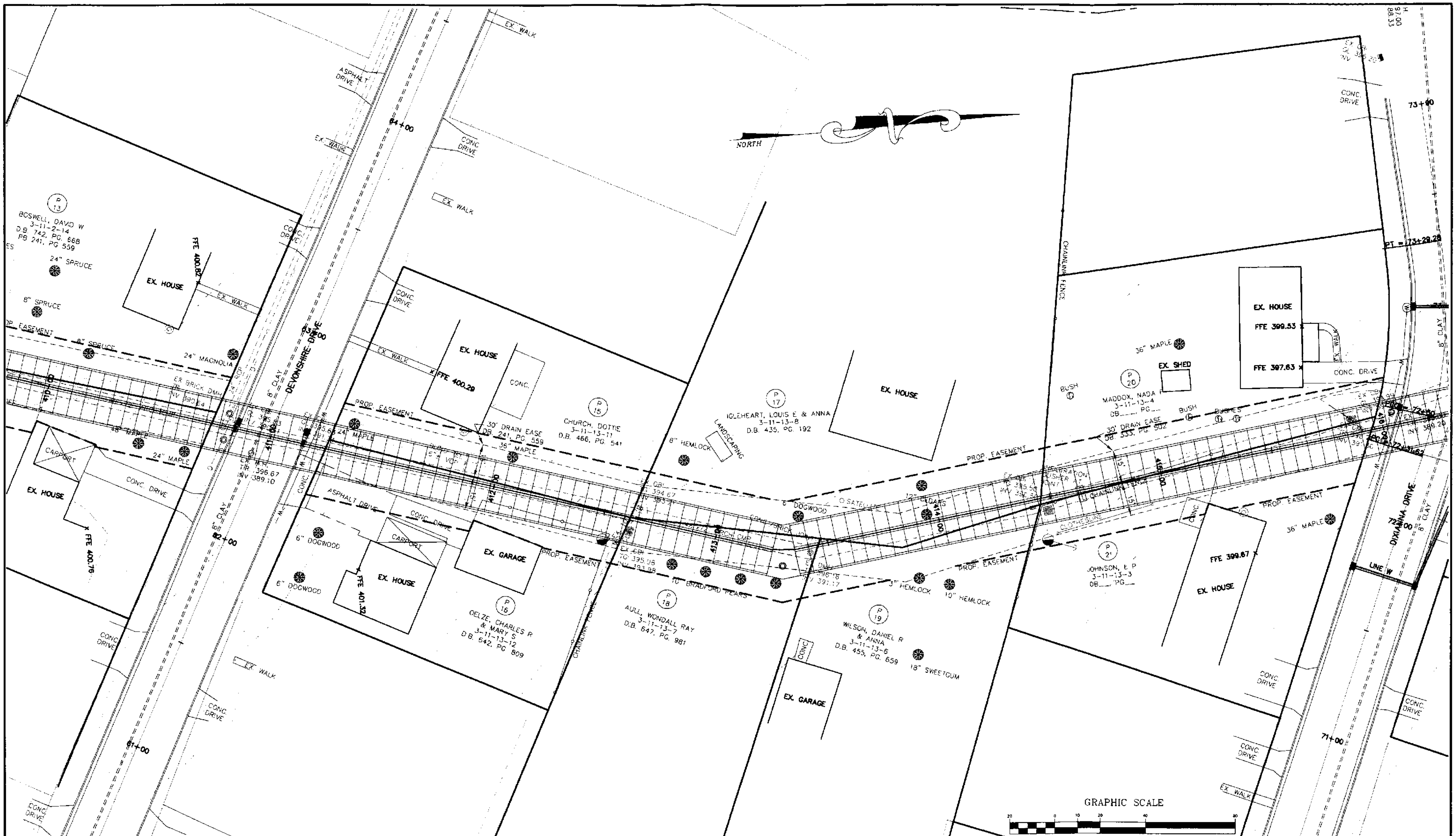
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2006
SCALE: 1"=20'
JOB NO.: 07-3966
SHEET 37 OF 81

BEI BRYANT ENGINEERING INC.
Civil Engineering - Land Surveying
270-685-2811



STA. 410+00 TO 416+00

OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

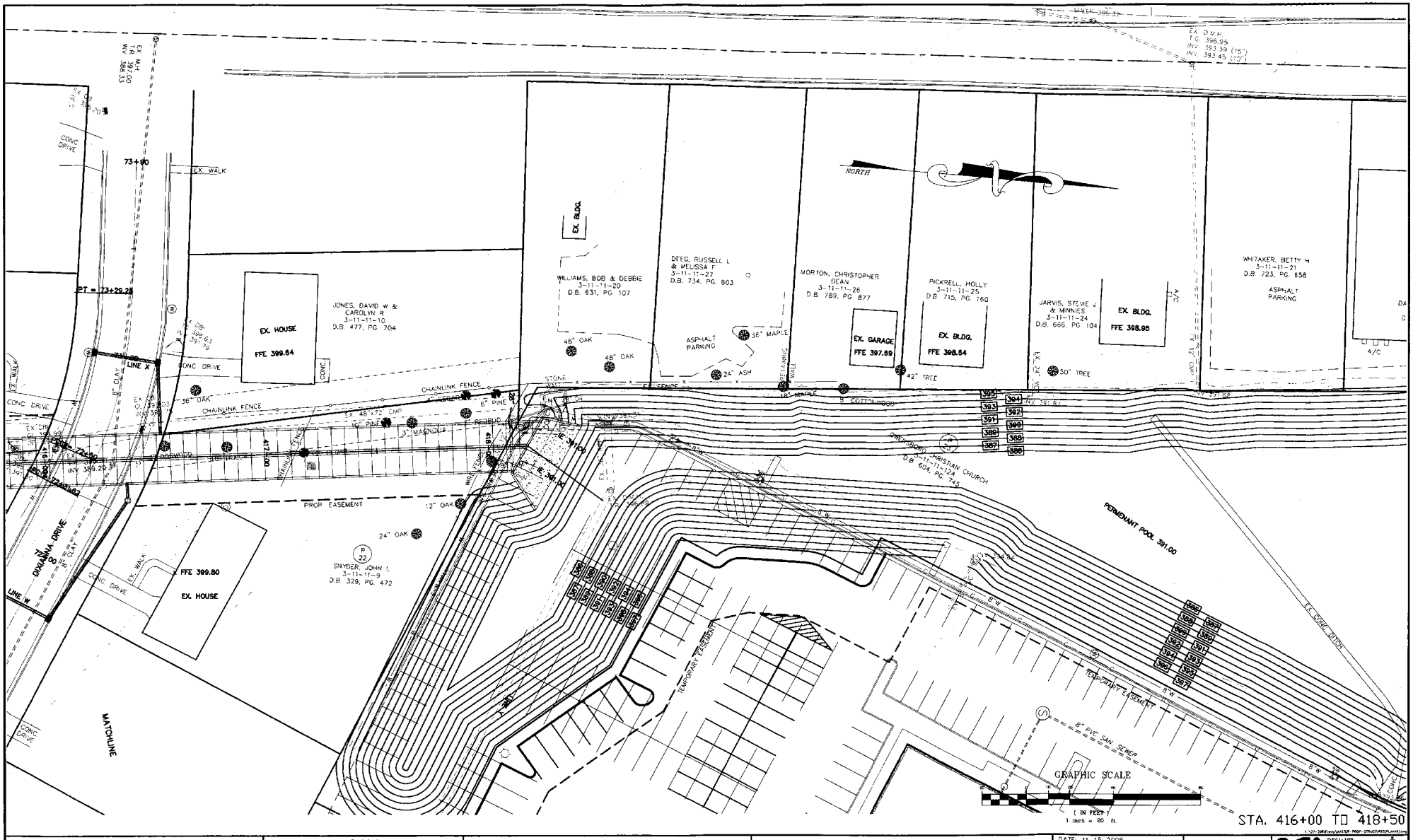
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

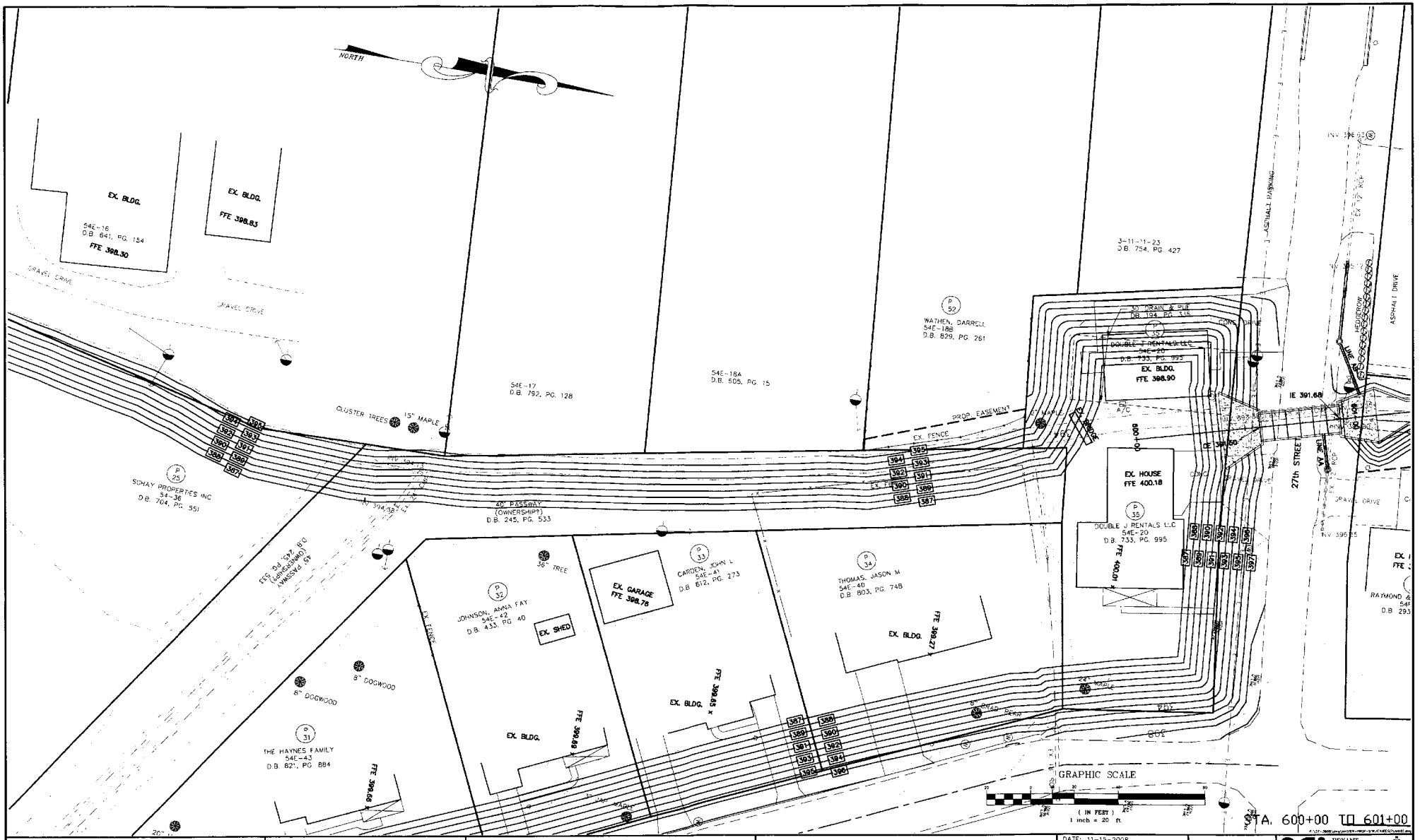
DATE: 11-15-2008
SCALE: 1"=20'
JOB NO. 07-3968
SHEET 39 OF 81

BEi BRYANT ENGINEERING INC.
Civil Engineering - Land Surveying
270-685-2811



OWNER/DEVELOPER **CITY OF OWENSBORO** P.O. BOX 10003 OWENSBORO, KY 42302	REVISIONS NO. DATE DESCRIPTION BY	**PLAN VIEW**	**HARSH DITCH** **OWENSBORO, KENTUCKY** DATE: 11-15-2008 SCALE: 1"=20' JOB NO.: 07-3968 SHEET 41 OF 81

BEI BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

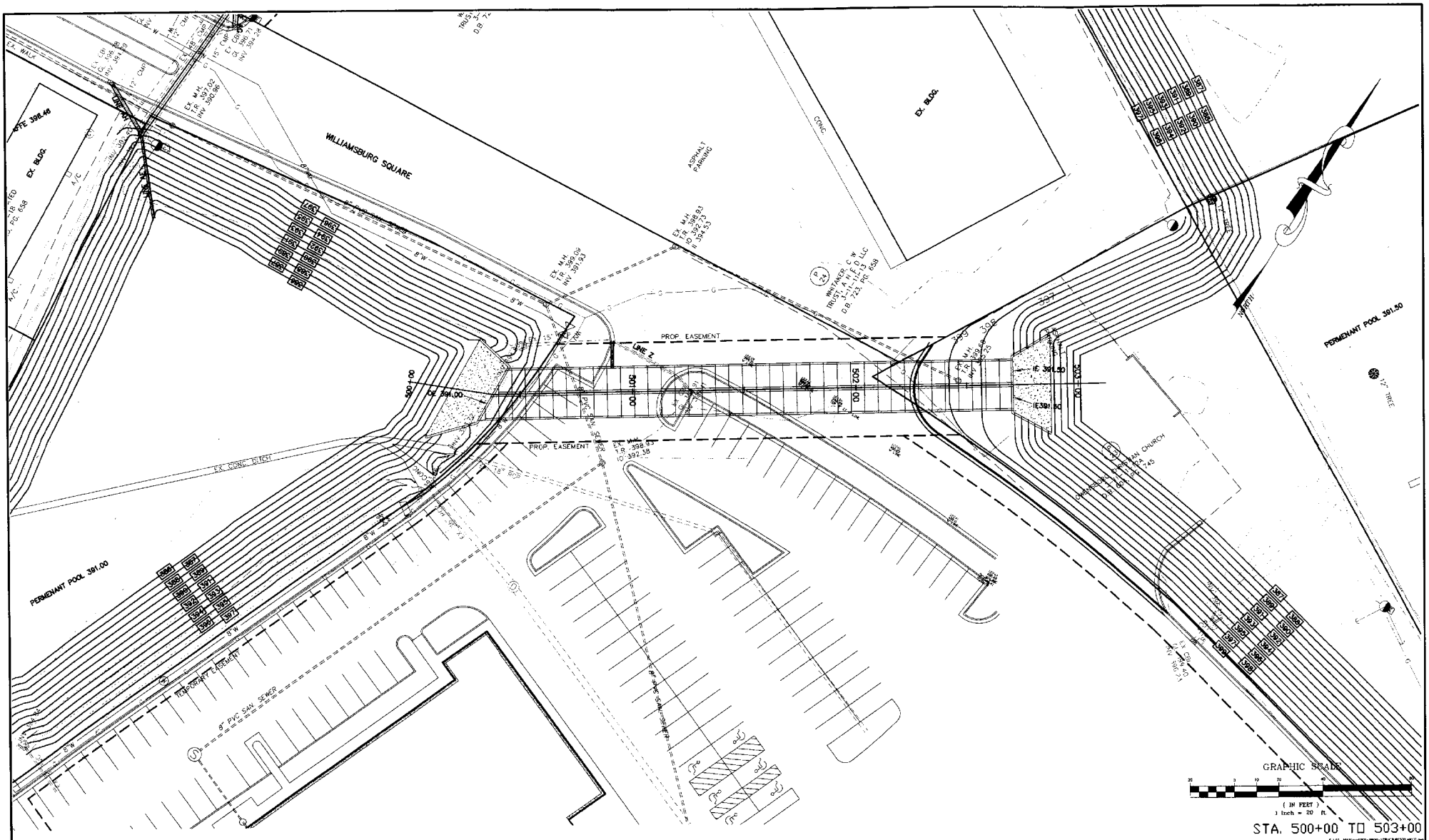
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 45 OF 81

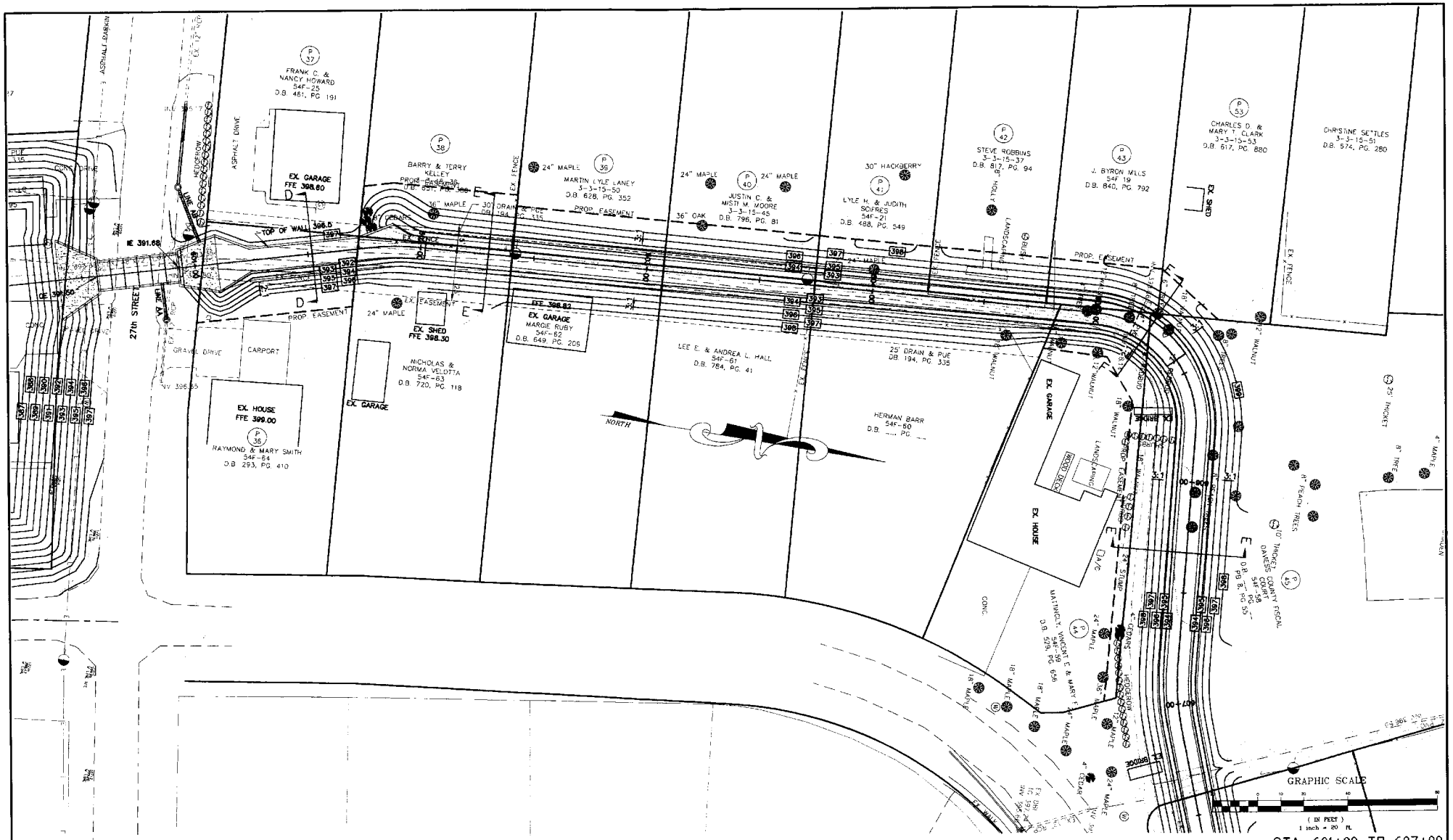
BEi BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
4215 BENTRIDGE DRIVE
P.O. BOX 10302
OWENSBORO, KENTUCKY 42304
270-685-2811



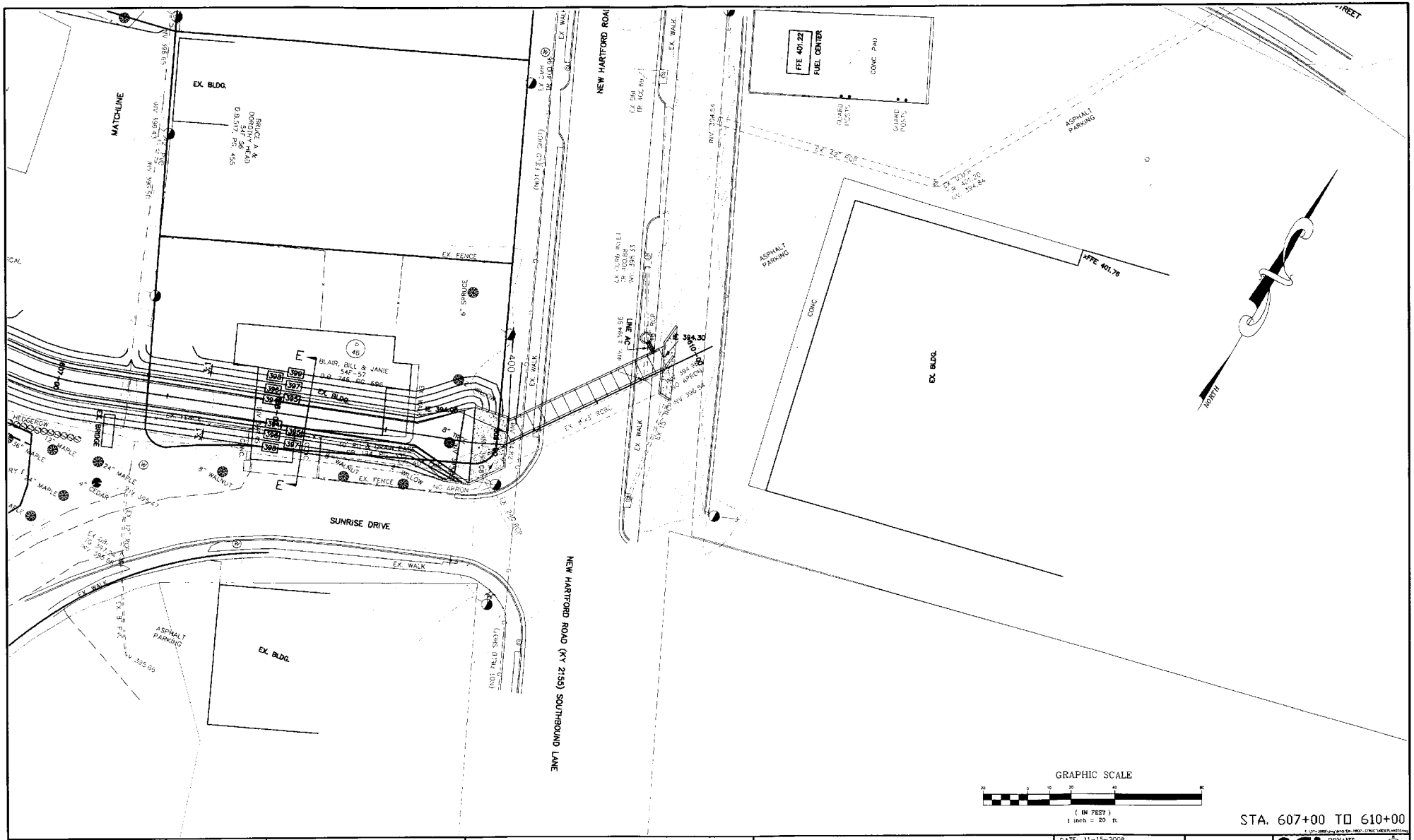
OWNER/DEVELOPER **CITY OF OWENSBORO** P.O. BOX 10003 OWENSBORO, KY 42302	REVISIONS NO. DATE DESCRIPTION BY	**PLAN VIEW**	**HARSH DITCH** **OWENSBORO, KENTUCKY**

DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 43 OF 81

BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-2811



OWNER/DEVELOPER CITY OF OWENSBORO P.O. BOX 10003 OWENSBORO, KY 42302	REVISIONS NO. DATE DESCRIPTION BY	PLAN VIEW	HARSH DITCH OWENSBORO, KENTUCKY	DATE: 11-15-2008 SCALE: 1"=20' JOB NO.: 07-3968 SHEET 47 OF 81	BRYANT ENGINEERING INC. Civil Engineering · Land Surveying 270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

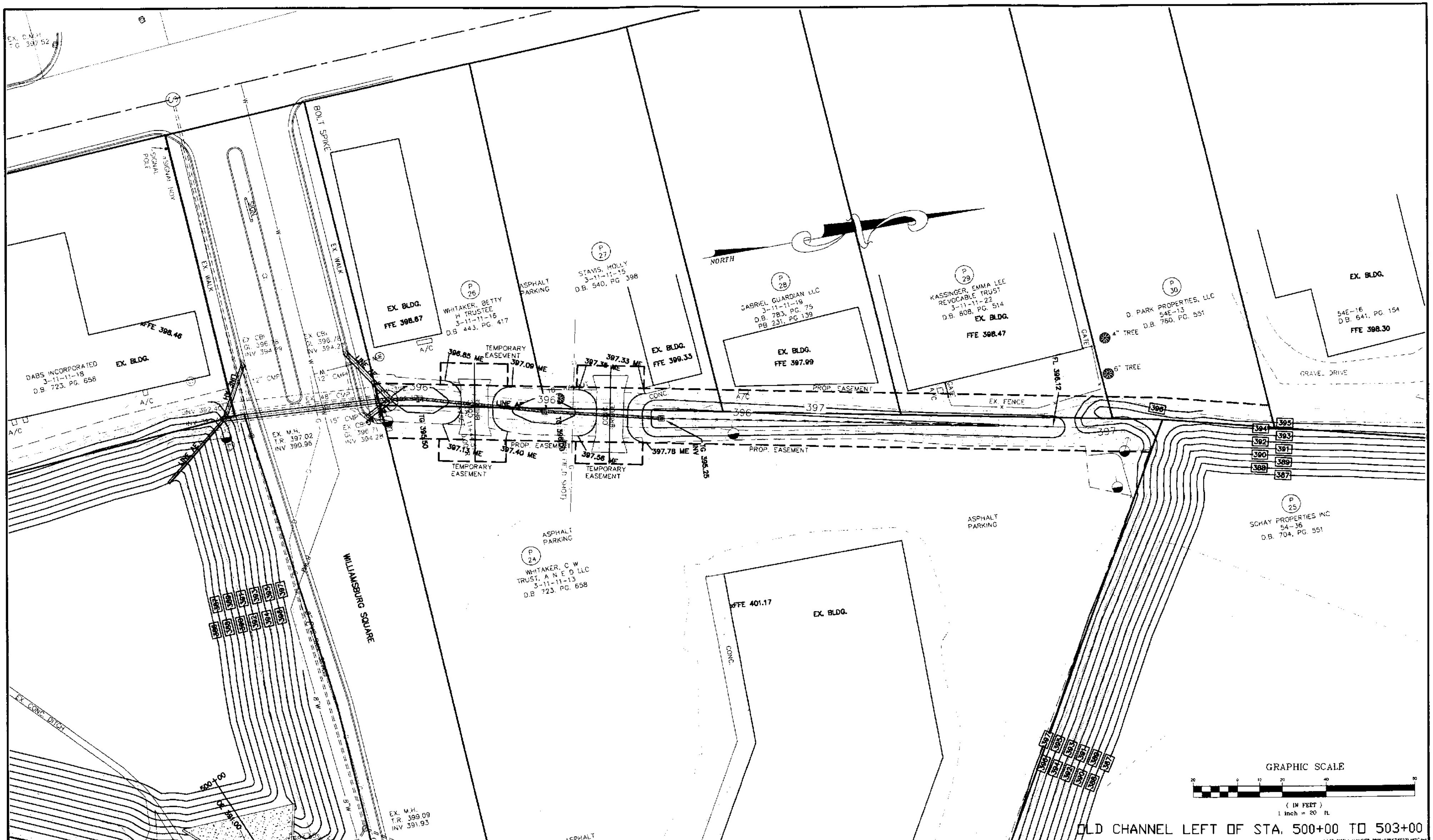
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PLAN VIEW

HARSH DITCH
OWENSBORO, KENTUCKY

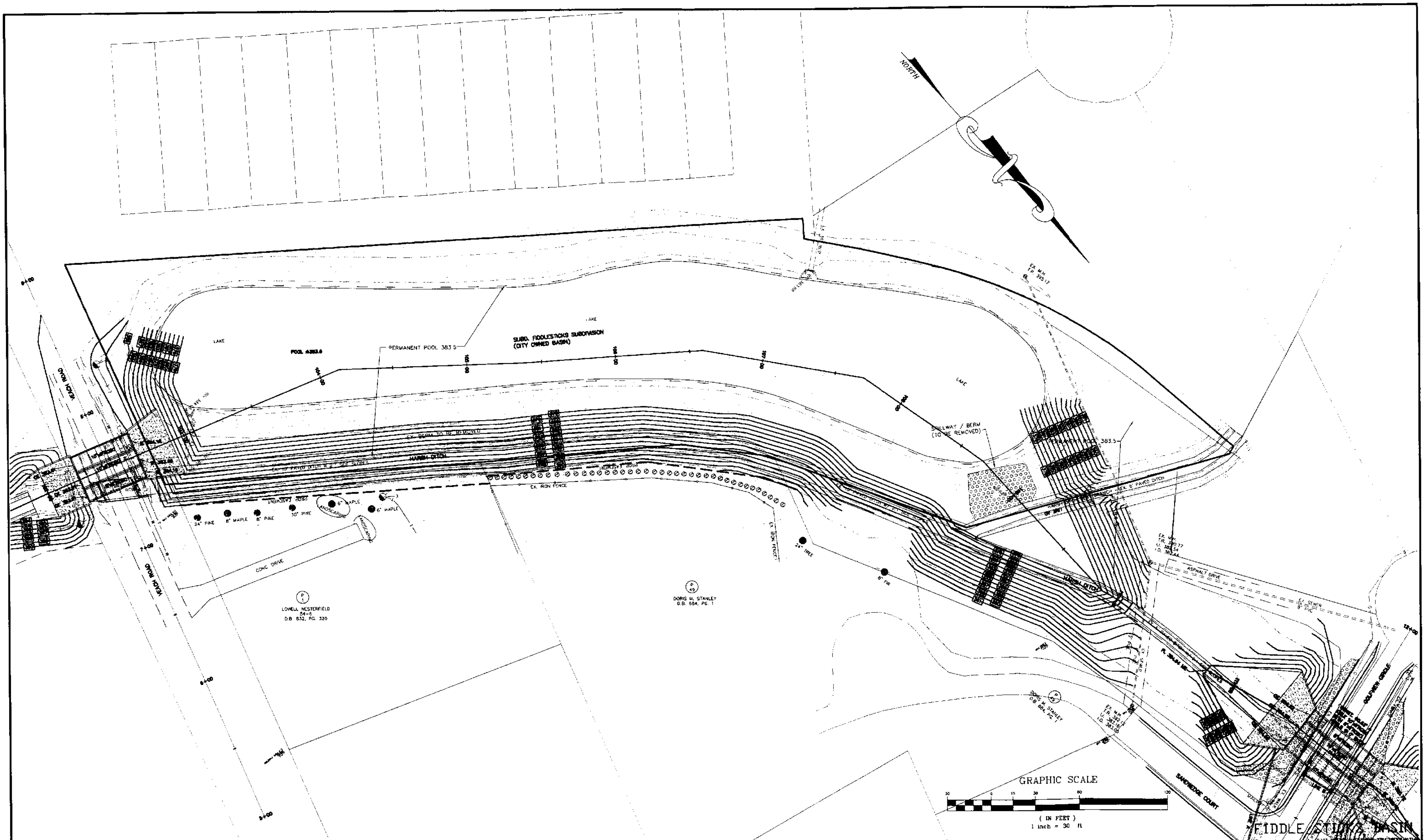
DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3988
SHEET 49 OF 81

BEI BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
P.O. BOX 10382
OWENSBORO, KENTUCKY 42304
270-685-2811

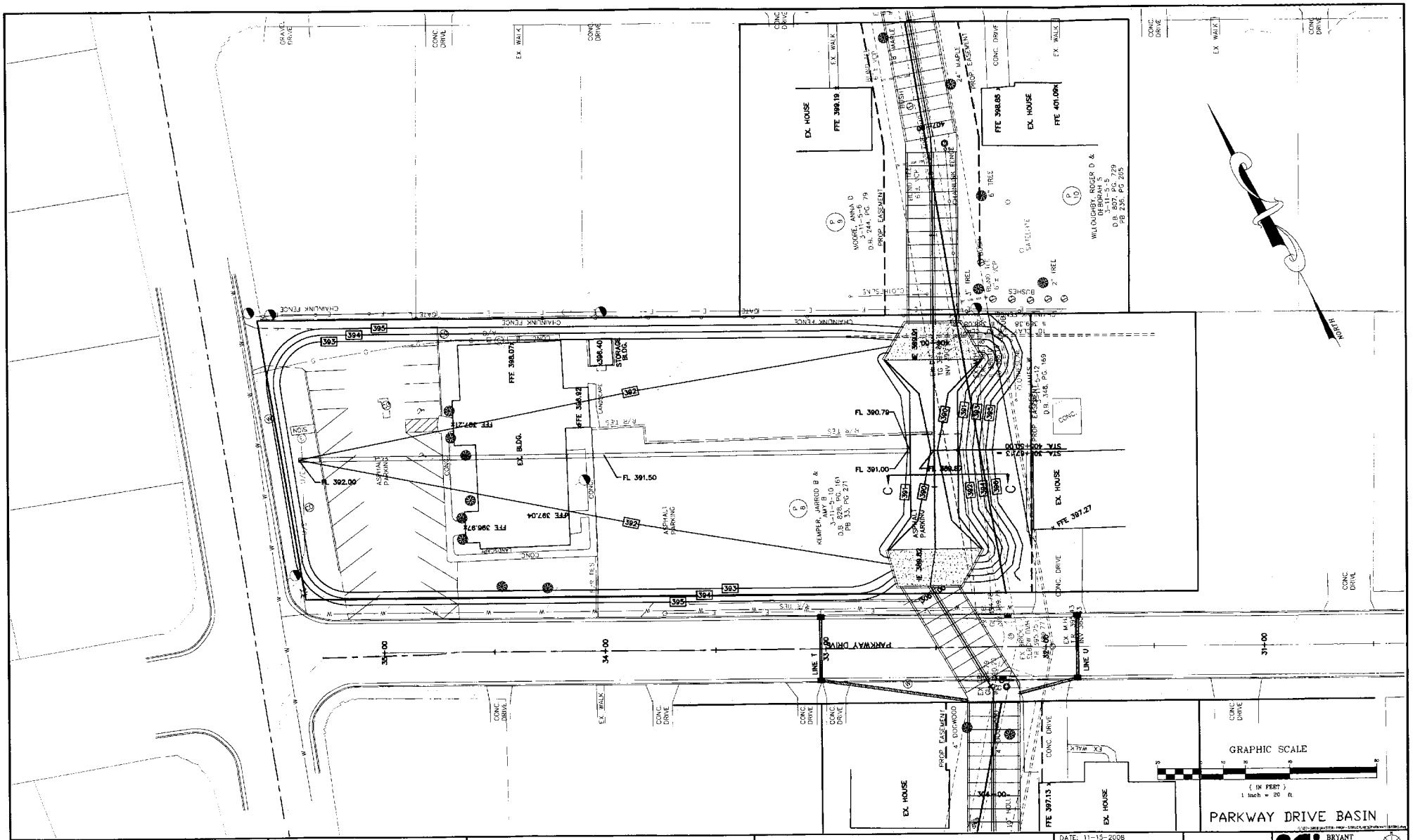


OLD CHANNEL LEFT OF STA. 500+00 TO 503+00

OWNER/DEVELOPER	REVISIONS	PLAN VIEW	HARSH DITCH	DATE: 11-15-2008	BEI BRYANT ENGINEERING INC.
CITY OF OWENSBORO	NO. / DATE / DESCRIPTION / BY		OWENSBORO, KENTUCKY	SCALE: 1"=20'	Civil Engineering · Land Surveying
P.O. BOX 10003				JOB NO.: 07-3968	270-685-2811
OWENSBORO, KY 42302				SHEET 51 OF 81	



OWNER/DEVELOPER	REVISIONS							
CITY OF OWENSBORO P.O. BOX 10003 OWENSBORO, KY 42302	NO.	DATE	DESCRIPTION	BY	FIDDLE STICKS BASIN	HARSH DITCH OWENSBORO, KENTUCKY	DATE: 11-15-2008 SCALE: 1"=30' JOB NO. 07-3968 SHEET 52 OF 81	BEi BRYANT ENGINEERING INC. Civil Engineering · Land Surveying 270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

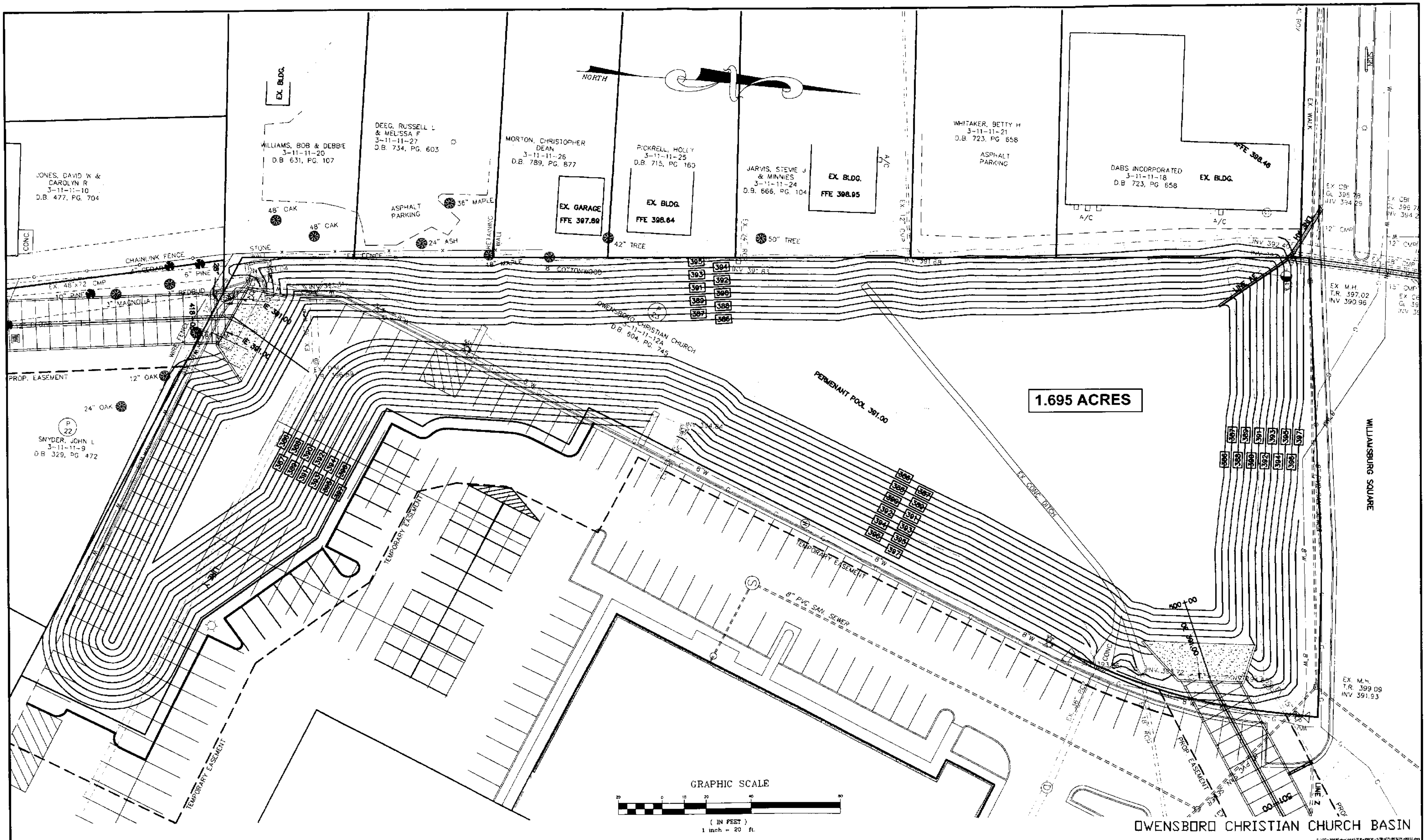
REVISIONS			
NO.	DATE	DESCRIPTION	BY

PARKWAY DRIVE BASIN

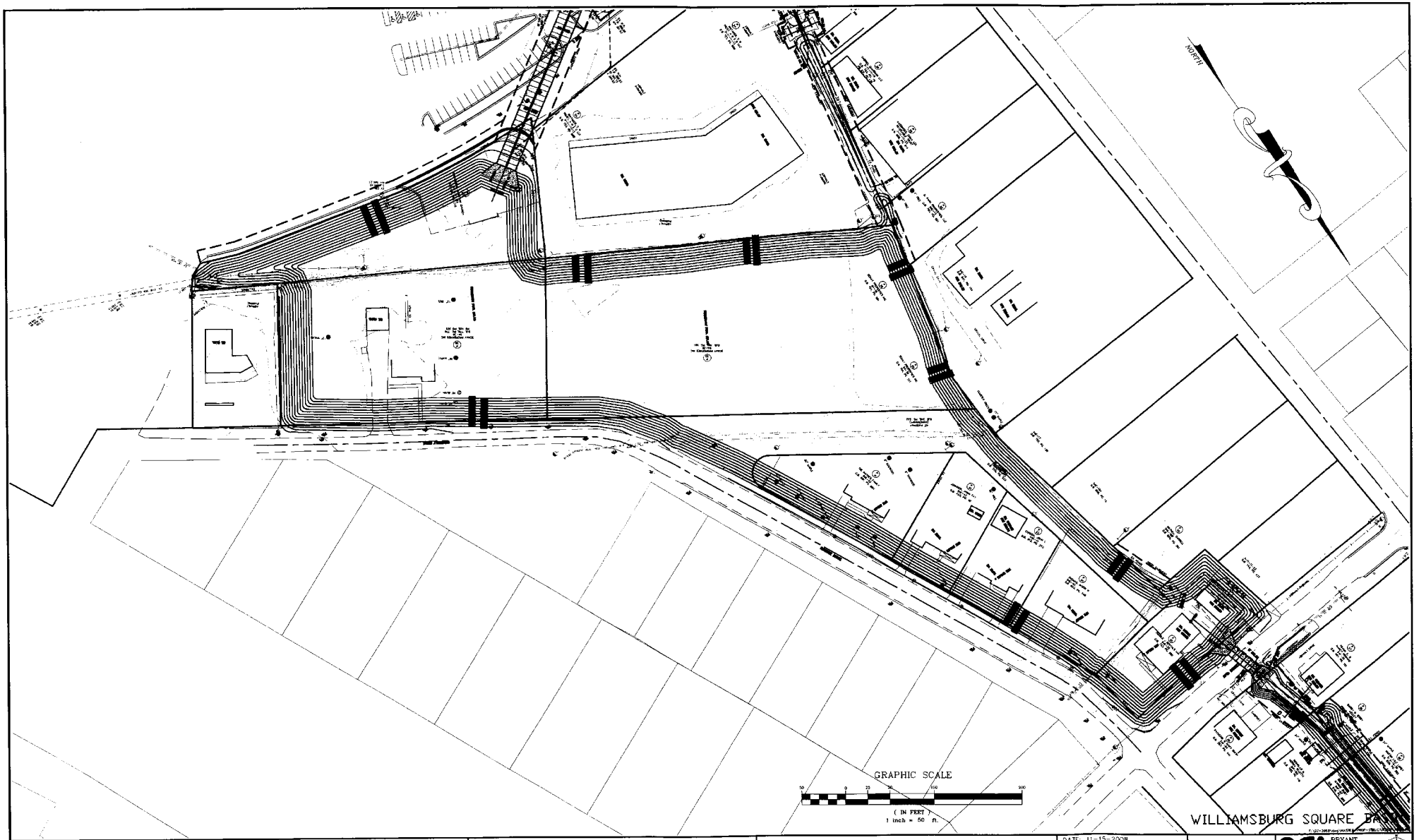
HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: 1"=20'
JOB NO.: 07-3968
SHEET 53 OF 81

BEI BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-8811



OWNER/DEVELOPER	REVISIONS							
CITY OF OWENSBORO P.O. BOX 10003 OWENSBORO, KY 42302	NO.	DATE	DESCRIPTION	BY	OWENSBORO CHRISTIAN CHURCH BASIN	HARSH DITCH OWENSBORO, KENTUCKY	DATE: 11-15-2008 SCALE: 1"=20' JOB NO.: 07-3968 SHEET 54 OF 81	BEi BRYANT ENGINEERING INC. Civil Engineering · Land Surveying 270-685-2811



OWNER/DEVELOPER
CITY OF OWENSBORO
P.O. BOX 10003
OWENSBORO, KY 42302

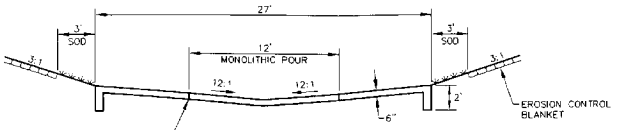
REVISIONS			
NO.	DATE	DESCRIPTION	BY

WILLIAMSBURG SQUARE BASIN

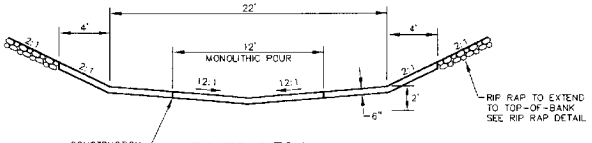
HARSH DITCH
OWENSBORO, KENTUCKY

DATE: 11-15-2008
SCALE: 1"=50'
JOB NO.: 07-3968
SHEET 55 OF 81

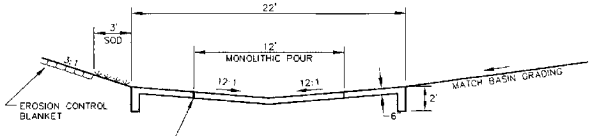
BEi BRYANT ENGINEERING INC.
Civil Engineering · Land Surveying
270-685-2811



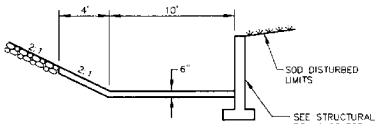
PAVED DITCH
SECTION A–A
NOT TO SCALE



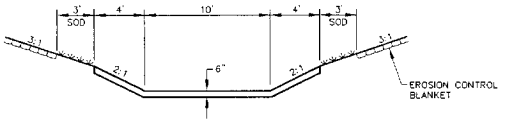
PAVED DITCH
SECTION B–B
NOT TO SCALE



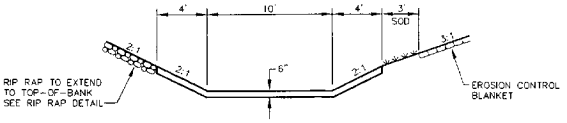
PAVED DITCH
SECTION C–C
NOT TO SCALE



PAVED DITCH
SECTION D–D
NOT TO SCALE



PAVED DITCH
SECTION E–E
NOT TO SCALE



PAVED DITCH
SECTION F–F
NOT TO SCALE

NOTE:
AN EROSION CONTROL BLANKET AS PER SECTIONS 212 AND 827 OF THE KYTC STANDARD SPECIFICATIONS SHALL BE INSTALLED FROM THE EDGE OF SOD TO THE TOP OF BANK.

OWNER/DEVELOPER **CITY OF OWENSBORO** P.O. BOX 10003 OWENSBORO, KY 42302	REVISIONS NO. DATE DESCRIPTION BY	**MISC. DETAILS**	**HARSH DITCH** **OWENSBORO, KENTUCKY** DATE: 11-15-2008 SCALE: N.T.S. JOB NO.: 07-3968 SHEET 79 OF 81	BEI BRYANT ENGINEERING INC. Civil Engineering · Land Surveying 270-685-2811

PROJECT PHOTOGRAPHS

Photo. #1

Existing bridge to be replaced with box culvert

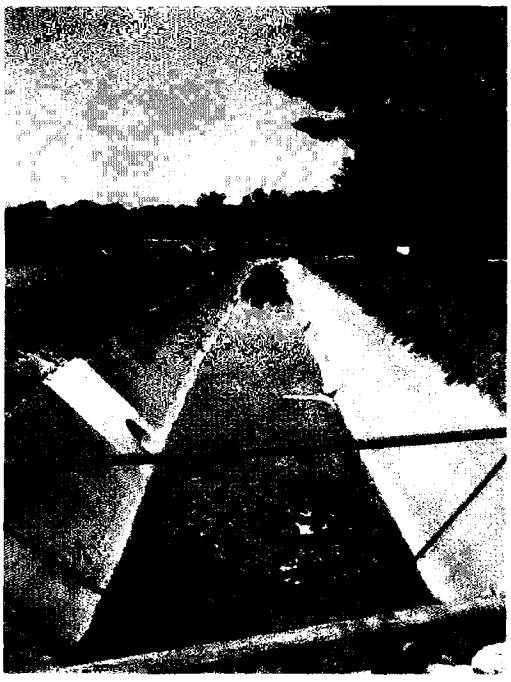


Photo. #2

Existing berm & paved ditch to be removed. The existing basin to be enlarged.

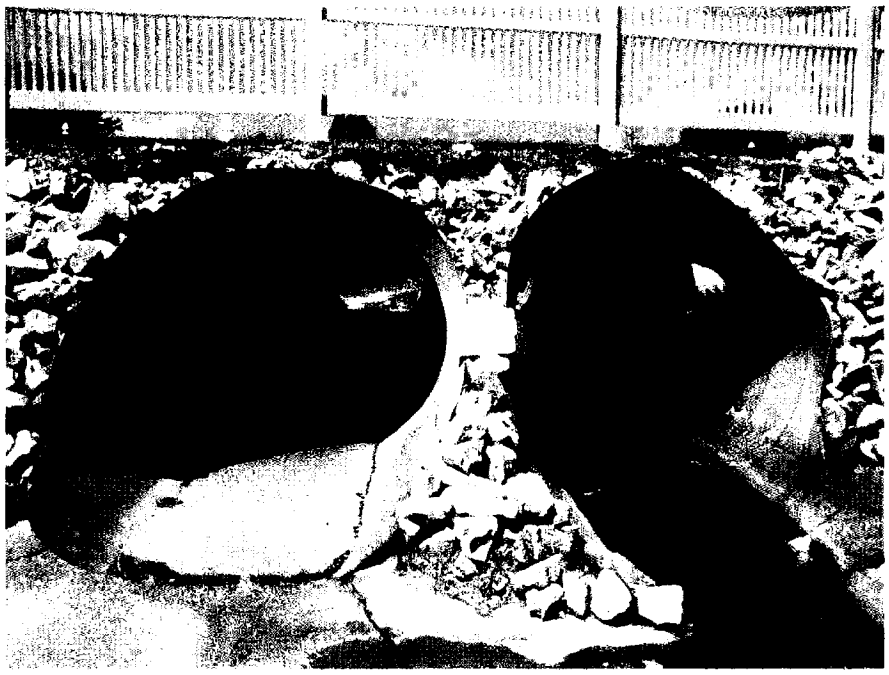


Photo. #3

Existing double 72" CMP to be removed and replaced with double 10'x4' RCBC

Photo. #4

Existing channel to be raised and guardrail eliminated

Photo. #5

Existing concrete channel to be widened

Photo. #6

Existing dry basin to be replaced with a larger wet basin.

Photo. #7

Existing channel to be raised.

Photo. #8

Existing channel to be raised. Picture taken during a high water event.

Photo. #9

Existing dry basin during high water event. Basin to be enlarged as a wet basin.

Photo. #10

Existing channel to be enlarged and paved.

HYDRAULIC MODEL

HYDROLOGIC AND HYDRAULIC ANALYSIS FOR HARSH DITCH

CITY OF OWENSBORO, KENTUCKY

FINAL REPORT

FEBRUARY 2009

Prepared for:

Bryant Engineering, Inc.
P.O. Box 21382
Owensboro, KY 42304

Prepared by:

CDP Engineers
3250 Blazer Parkway
Lexington, KY 40509

HYDROLOGIC AND HYDRAULIC ANALYSIS

Harsh Ditch Watershed

Harsh Ditch comprises an approximately 1,971-acre drainage area extending from just south of the U.S. HWY 60 Bypass at its confluence with Horse Fork and is bounded by Frederica Street to the west and by Parrish Avenue to the east. Currently, Harsh Ditch does not drain the entire watershed due to a combination sewer system that accepts both sanitary and storm water flows. Within the Harsh Ditch watershed there are 732-acres of combination sewer areas and 1,239-acres of straight storm water areas. Harsh ditch as it is designed today (2009) only drains that portion of the watershed which contains the straight storm-water areas.

Harsh Ditch is a backwater controlled system. During rain events the backwater originates in Horse Fork and the elevated water surface propagates upstream into Harsh Ditch. In addition to the backwater from Horse Fork the Main Channel of Harsh Ditch also exhibits drainage problems created by lengthy stretches of open channel having been replaced by undersized drainage pipe laid on a flat grade. Other flooding problems along the Main Channel are due to the naturally flat topography and areas located in depressions which cannot develop sufficient head to drain until backwater elevations downstream have abated.

For the purpose of this study three (3) models were developed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) version 3.1.0 for the hydrologic analysis and the Hydrologic Engineering Center's River Analysis System (HEC-RAS) version 4.0 for the hydraulic analysis. The models presented in this report are: Model #1 which is a calibration model to the 1997 FIRM, Model #2 is an existing conditions model for Harsh Ditch as it is in 2009, Model #3 shows improvements proposed for Harsh Ditch to reduce flooding in the streets for the current drainage area of 1,239-acres with an additional 15-acres of combination sewer area.

Project Goals

The goal for the Harsh Ditch Phase II Drainage Improvement project as set forth by the City of Owensboro is to reduce flooding in the streets so that emergency vehicles can access citizens' homes for the 25yr event and the additional goal of storm-water removal from the combination sewer system. This project also seeks to provide a main storm-water conveyance system that can be added to in the future. Improvements proposed for Harsh Ditch follows the Owensboro storm-water master plan which recommends construction of retention basins and channel reconstruction on portions of the main Harsh Ditch branch with a series of box culverts and paved channels. These improvements will add more storage capacity to the undersized system and will allow a small portion of storm-water to be removed from the combination sewer system.

Hydrologic Methodology

Hydrological analysis was carried out to establish the peak discharge-frequency relationship for Harsh Ditch. The hydrologic computations were performed with the computer program HEC-HMS version 3.1.0. Hydrologic parameters were based on the Soil Conservation Service (SCS) Curve Number (CN) Methodology outlined in Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55).

Design Storm

The SCS Type II distribution 24-hr storm duration was used to simulate the temporal distribution of rainfall in three minute intervals. The total volume of rain for each return frequency was obtained from Kentucky *Engineering Memorandum No. 2: Rainfall Frequency Values for Kentucky, Revised June 1, 1979* and is shown in Table 1.

Table 1 Rainfall Depths for Selected Storm Frequencies

Storm Duration (hour)	Storm Frequency (year)	Rainfall Depth (inches)
24	10	4.7
24	25	5.5
24	50	6.0
24	100	6.5

Drainage Area

The watershed and sub-watersheds were delineated using a previous study performed by Johnson, Depp and Quisenberry Consulting Engineers and basemap layers (two-foot contour mapping and aerial photograph) supplied by the City of Owensboro. Harsh Ditch watershed is approximately 1,971-acres, 732-acres are drained by a combination sewer system and the remaining 1,239-acres of dedicated storm water drains into Harsh Ditch. The watershed was divided into sub-watersheds approximately ranging in size from 0.02 – 1.03 square miles for three (3) different models. The different scenarios are listed below:

Model #1 (Calibration Model):
Total Area = 1,971-acres (100% combination sewer areas) Table 2

Model #2 (Existing Conditions):
Total Area = 1,239-acres (0% combination sewer areas) Table 3

Model #3 (Proposed Improvements):
Total Area = 1,254-acres (2% combination sewer areas) Table 4

Time of Concentration

Time of concentration values were calculated for each sub-watershed using the methodology outlined in TR-55. Times of concentration for this study ranged from 13 to 75 minutes.

Curve Number Generation

A weighted curve number was generated for each sub-watershed using the SCS Hydrologic Soil Group (HSG) and land use coverages as outlined in TR-55.

Table 2
Sub-Watersheds With 100% of Combined Sewer Areas

SUB WATERSHED	100% CSO (SQMI)	100% CSO (Acres)	Time of Concentration (min)	CN	10-year (cfs)	25-year (cfs)	50-year (cfs)	100-year (cfs)
1	0.27	175.3	52	74.59	158.7	208.4	240.4	272.9
2	0.55	352.3	73	85.02	366.4	453.4	508.3	563.2
3	0.06	40.6	26	74.79	57.9	75.9	87.5	99.2
4	1.03	661.6	75	79.05	549.7	702.6	800	898.2
5	0.04	25.7	36	79.75	37.4	47.6	54	60.5
6	0.16	99.7	28	82.11	193.1	242.1	273	304.1
7	0.06	36.5	13	84.53	122.7	151.4	169.5	187.6
8	0.08	52.4	13	78.75	136	173.2	196.8	220.6
81	0.21	131.7	33	78	195.7	251.2	286.6	322.3
82	0.02	12.5	14	78	31.7	40.6	46.3	52
9	0.02	9.6	17	81.22	32	40.2	45.5	50.7
10	0.06	40	14	82.95	112.4	140.1	157.5	175
11	0.03	20.2	17	81.28	48	60.4	68.3	76.2
12	0.49	312.4	60	79.61	313.2	398.9	453.5	508.6
Totals	**3.08**	**1971**						

Table 3
Sub-Watersheds With 0% of Combined Sewer Areas

SUB WATERSHED	0% CSO Existing (SQMI)	0% CSO Existing (Acres)	Time of Concentration (min)	CN	10-year (cfs)	25-year (cfs)	50-year (cfs)	100-year (cfs)
1	0.27	173.2	52	74.59	158.7	208.4	240.4	272.9
2	0.55	354.4	73	85.02	366.4	453.4	508.3	563.2
3	0.06	40.6	26	74.79	57.9	75.9	87.5	99.2
4	0.38	244.5	50	79.05	274.1	350.1	398.3	447.1
5	0.03	19.8	36	79.75	28.1	35.7	40.5	45.4
6	0.16	99.7	28	82.11	193.1	242.1	273.0	304.1
7	0.06	36.4	13	84.53	122.7	151.4	169.5	187.6
8	0.08	52.5	13	78.75	136.0	173.2	196.8	220.6
81	0.21	131.7	33	78	195.7	251.2	286.6	322.3
82	0.02	12.5	14	78	31.7	40.6	46.3	52.0
9	0.01	6.2	17	81.22	32.0	40.2	45.5	50.7
10	0.04	28.2	14	82.95	112.4	140.1	157.5	175.0
11	0.04	22.7	17	81.28	48.0	60.4	68.3	76.2
12	0.03	16.5	15	79.61	16.2	20.5	23.2	26.0
Totals	**1.94**	**1239**						

Table 4
Sub-Watersheds With 2% of Combined Sewer Areas

SUB WATERSHED	2% CSO FUTURE (SQMI)	2% CSO FUTURE (Acres)	Time of Concentration (min)	CN	10-year (cfs)	25-year (cfs)	50-year (cfs)	100-year (cfs)
1	0.27	170.20	52	74.59	158.7	208.4	240.4	272.9
2	0.56	357.45	73	85.02	373.0	461.7	517.5	573.5
3	0.06	40.65	26	74.79	57.9	75.9	87.5	99.2
4	0.38	246.00	50	79.05	274.1	350.1	398.3	447.1
5	0.04	25.66	36	79.75	37.4	47.6	54.0	60.5
6	0.13	80.54	28	82.11	156.9	196.7	221.8	247.1
61	0.03	19.17	10	82.11	64.2	80.2	90.2	100.3
7	0.06	36.42	13	84.53	122.7	151.4	169.5	187.6
8	0.08	54.00	13	78.75	136.0	173.2	196.8	220.6
81	0.21	131.72	33	78	195.7	251.2	286.6	322.3
82	0.02	12.55	14	78	31.7	40.6	46.3	52.0
9	0.02	15.50	17	81.22	32.0	40.2	45.5	50.7
10	0.06	40.03	14	82.95	112.4	140.1	157.5	175.0
11	0.03	20.22	17	81.28	48.0	60.4	68.3	76.2
12	0.01	3.94	15	79.61	16.2	20.5	23.2	26.0
12B	0.27	170.20	52	74.59	158.7	208.4	240.4	272.9
Totals	**1.96**	**1254**						

Hydraulic Methodology

The hydraulic computations were performed with the HEC-RAS version 4.0 computer program. Input parameters used in the model were based on the infrastructure information collected by Bryant Engineering Inc. In addition the City of Owensboro supplied GIS data (two-foot contours, ditch and pipe locations, transportation features and parcel delineation) which were used to augment the survey data. Manning's roughness values for the storm sewer and open-channels were based on the values published in *Storm Water Collection Systems Design Handbook, 2001.* Modeling of Harsh Ditch includes the 10-, 25-, 50- and 100-year annual chance events based on peak discharges calculated in the hydrologic analyses. Modeling assumed that storm water collection system was free of debris and in good condition.

Calibration Model

The calibration model is essentially a FEMA Corrected Effective Model that incorporates updated hydraulic structure information and cross sections created with more detailed topographic information. The calibration model duplicates the water surface elevations shown in the 1997 FIS profiles and in the Floodway Data Table to within 0.5ft as required by FEMA (in most locations).

Table 5 shows the water surface elevations generated from the 2008 calibration model compared to the water surface elevations shown in the 1997 FIS. It can be seen that the 2008 calibration model's water surface elevations deviate from the 1997 FIS elevations by more than 0.5ft at cross sections P, Q, R and S. These differences can be attributed to improved geometry data used in the 2008 model. The 1997 FIS model used interpolated and repeated cross sections that are not representative of this portion of Harsh Ditch. Cross sections P, Q, R and S are compared to the cross sections used in the 2008 model in Figures 1-4. It can be seen that the cross sections used in the 2008 model have higher bank stations and are generally more constricted than the 1997 FIS cross sections.

To show that the 2008 surveyed cross sections are more accurate, the 1997 FIS cross sections were used in the 2008 model at locations P, Q, R and S. The results from this model can be seen in Table 6 which shows that the water surface elevations duplicate the 1997 FIS elevations. It can be further shown in photos taken from a 2-day 4.18 rain event (almost 10-yr event) which occurred on March 19, 2008 that the double 48" CMP at Williamsburg square was overtopped. This structure is located in the vicinity of cross section Q where the 1997 FIS publishes a 100-yr elevation of 397.5. The crown of the road at this location is approximately 397. Therefore, it appears that a less than 10-yr event is within 0.5ft of the 100-yr water surface elevation. Due to this photographic documentation and that repeated and interpolated cross sections were used in these locations for the 1997 FIS, the engineer believes that the recently surveyed cross sections used in the 2008 model are more accurate.

Table 5
Calibration Model with New Surveyed Cross Sections

Cross Section	1997 FIS Regulatory[1] (FEET NGVD)	2008 Model Regulatory[1] (FEET NGVD)	Diff. (FEET)	1997 FIS Without Floodway[2] (FEET NGVD)	2008 Model Without Floodway[2] (FEET NGVD)	Diff. (FEET)
Harsh Ditch						
B	394.4	394.4	0.0	390.2	390.2	0.0
C	394.4	394.5	0.1	392.4	392.8	0.4
D	394.4	394.5	0.1	392.4	392.8	0.4
E	394.5	394.5	0.0	393.4	393.2	0.2
F	394.9	394.9	0.0	394.7	394.7	0.0
G	394.9	394.9	0.0	394.7	394.7	0.0
H	394.9	394.9	0.0	394.7	394.7	0.0
I	394.9	394.9	0.0	394.7	394.7	0.0
J	394.9	394.9	0.0	394.7	394.7	0.0
K	394.9	394.9	0.0	394.7	394.7	0.0
L	394.9	394.9	0.0	394.8	394.9	0.1
M	395.8	395.8	0.0	395.8	395.8	0.0
N	396.4	396.1	0.3	396.4	396.2	0.2
O	396.4	396.5	0.1	396.4	396.5	0.1
P	**397.3**	**398.1**	**0.8***	**397.3**	**398.1**	**0.8***
Q	**397.5**	**398.3**	**0.8***	**397.5**	**398.3**	**0.8***
R	**397.9**	**399.2**	**1.3***	**397.9**	**399.2**	**1.3***
S	**398**	**399.8**	**1.8***	**398**	**399.8**	**1.8***

[1]With Backwater

[2]Without Backwater

*Locations with water surface increase greater than 0.5ft

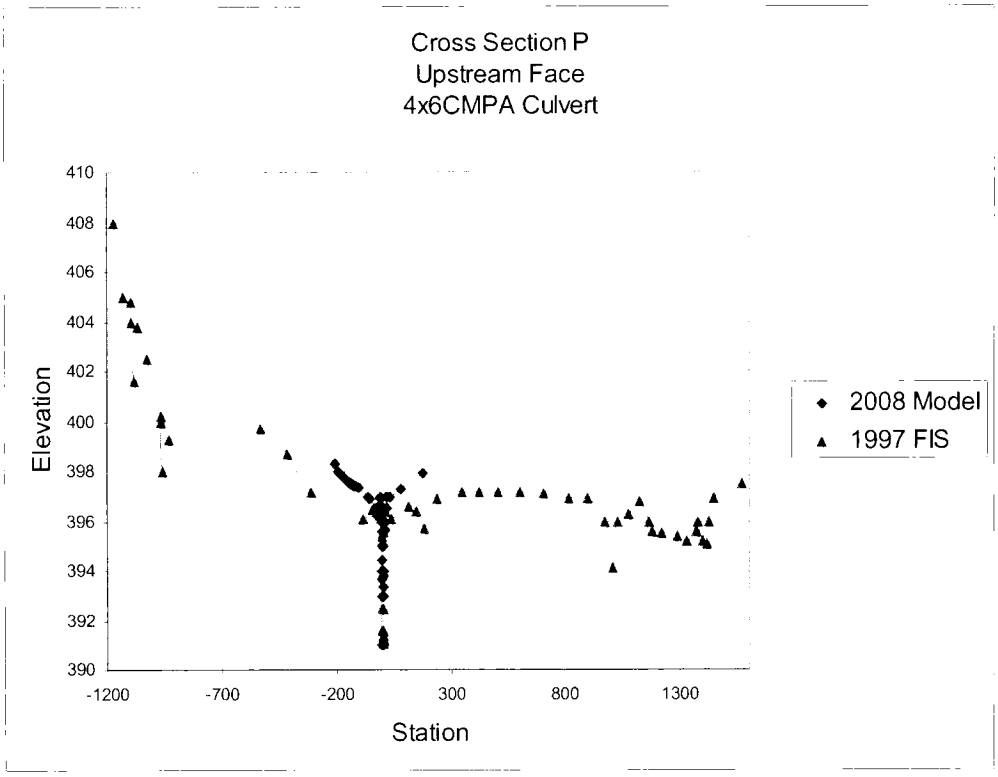


Figure 1

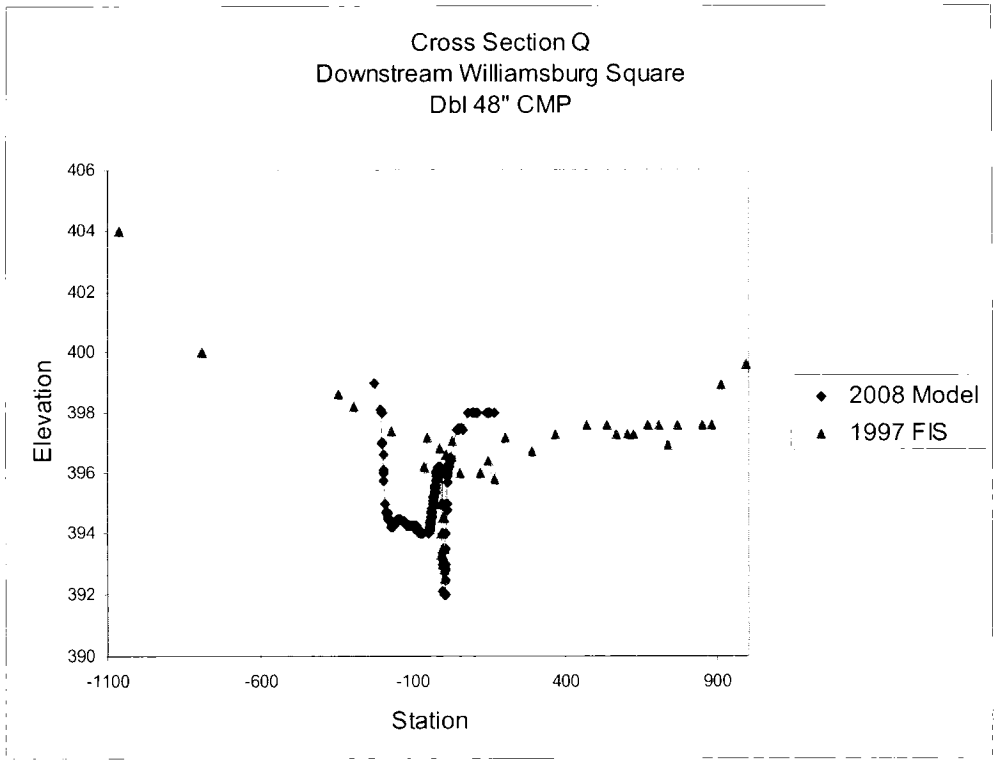


Figure 2

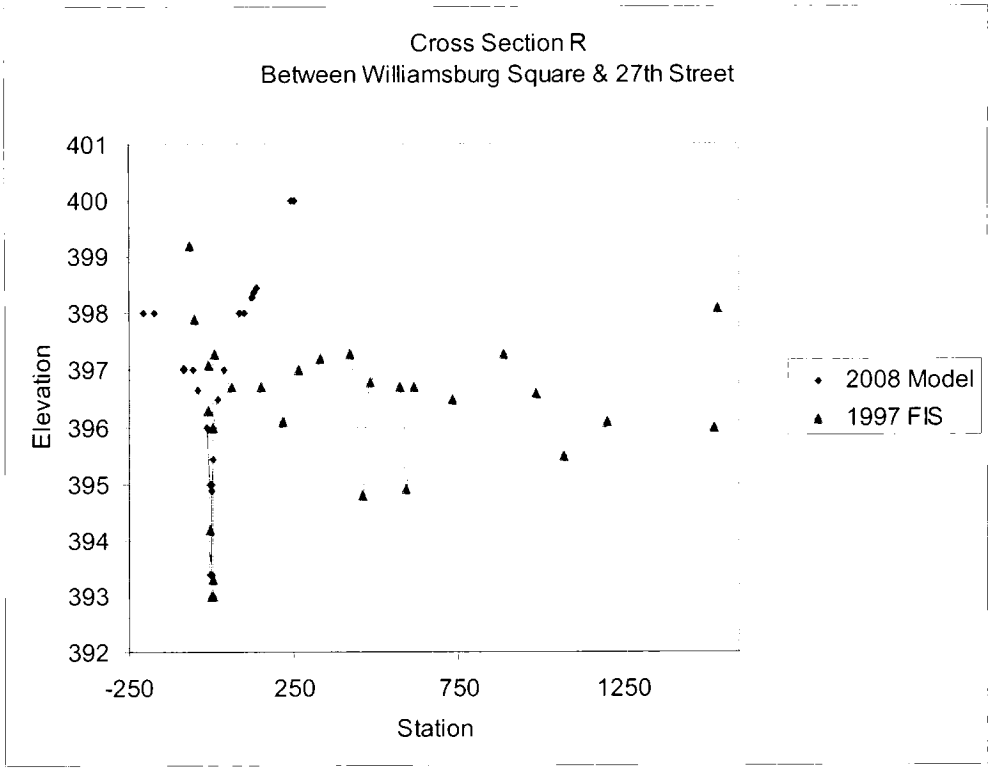


Figure 3

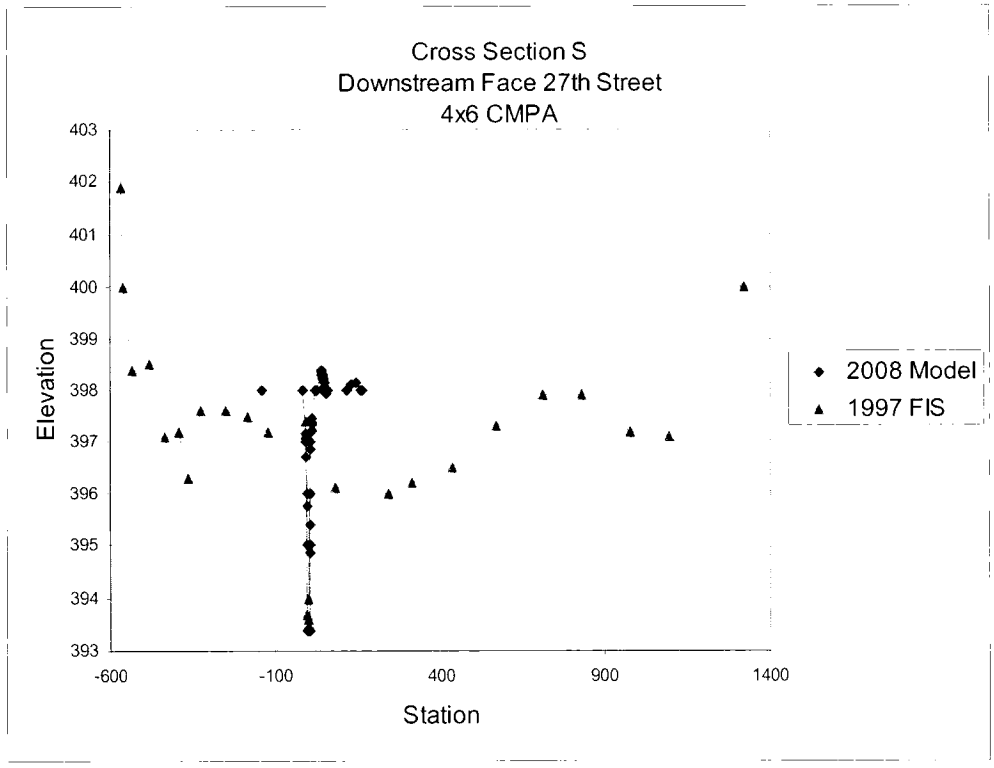


Figure 4

Table 6
Calibration Model with New Surveyed Cross Sections & Cross Sections from the 1997 FIS (Owensboro Christian Church to 27th Street)

Cross Section	1997 FIS Regulatory[1] (FEET NGVD)	2008 Model w/FEMA XS Regulatory[1] (FEET NGVD)	Diff. (FEET)	1997 FIS Without Floodway[2] (FEET NGVD)	2008 Model w/FEMA XS Without Floodway[2] (FEET NGVD)	Diff. (FEET)
Harsh Ditch						
B	394.4	394.5	0.1	390.2	390.2	0.0
C	394.4	394.5	0.1	392.4	392.8	0.4
D	394.4	394.5	0.1	392.4	392.8	0.4
E	394.5	394.5	0.0	393.4	393.2	0.2
F	394.9	394.9	0.0	394.7	394.7	0.0
G	394.9	394.9	0.0	394.7	394.7	0.0
H	394.9	394.9	0.0	394.7	394.7	0.0
I	394.9	394.9	0.0	394.7	394.7	0.0
J	394.9	394.9	0.0	394.7	394.7	0.0
K	394.9	394.9	0.0	394.7	394.7	0.0
L	394.9	394.9	0.0	394.8	394.9	0.1
M	395.8	395.8	0.0	395.8	395.8	0.0
N	396.4	396.2	0.2	396.4	396.2	0.2
O	396.4	396.5	0.1	396.4	396.5	0.1
P*	397.3	397.5	0.2	397.3	397.5	0.2
Q*	397.5	397.9	0.4	397.5	397.9	0.4
R*	397.9	398	0.1	397.9	398	0.1
S*	398	398	0.0	398	398	0.0

[1]With Backwater

[2]Without Backwater

*Locations with imported cross sections from the 1997 FIS

Existing Conditions Model

The existing conditions model is representative of how Harsh Ditch is today without improvements and is used in this study as a base from which to judge proposed upgrades. The existing structures are shown in Table 7. Overall, the structures are well undersized and create high backwater during large storms. Figure 5 shows the profile for the existing conditions model which currently accepts 0% of the combination sewer area.

Table 7
Existing Structures

Location	Quantity	Type	Length (ft)
Parking Lot Entrance	Single	3x4 CMPA	56
East 25th Street	Single	42" RCP	323
New Hartford Road	Single	3x8 RCBC	80
Residential Garage	Single	40" CMP	86
East 27th Street	Single	4x6 CMPA	27
Ridgeway Drive	Double	48" CMP	72
Devonshire	Single	4x6 CMPA	1495
Live Oak Place	Double	4x10 RCBC	73
East Byers Avenue	Single	54" RCP	580
Alexandria Place	Double	3x5 CMPA	80
Veach Road #2	Single	54" CMP	60
Owensboro CC Cart Path	Single	4x11.5 CMPA	34
Golfview Circle	Double	72" CMP	52
Veach Rd #1	Single	8x13 RCBC	25

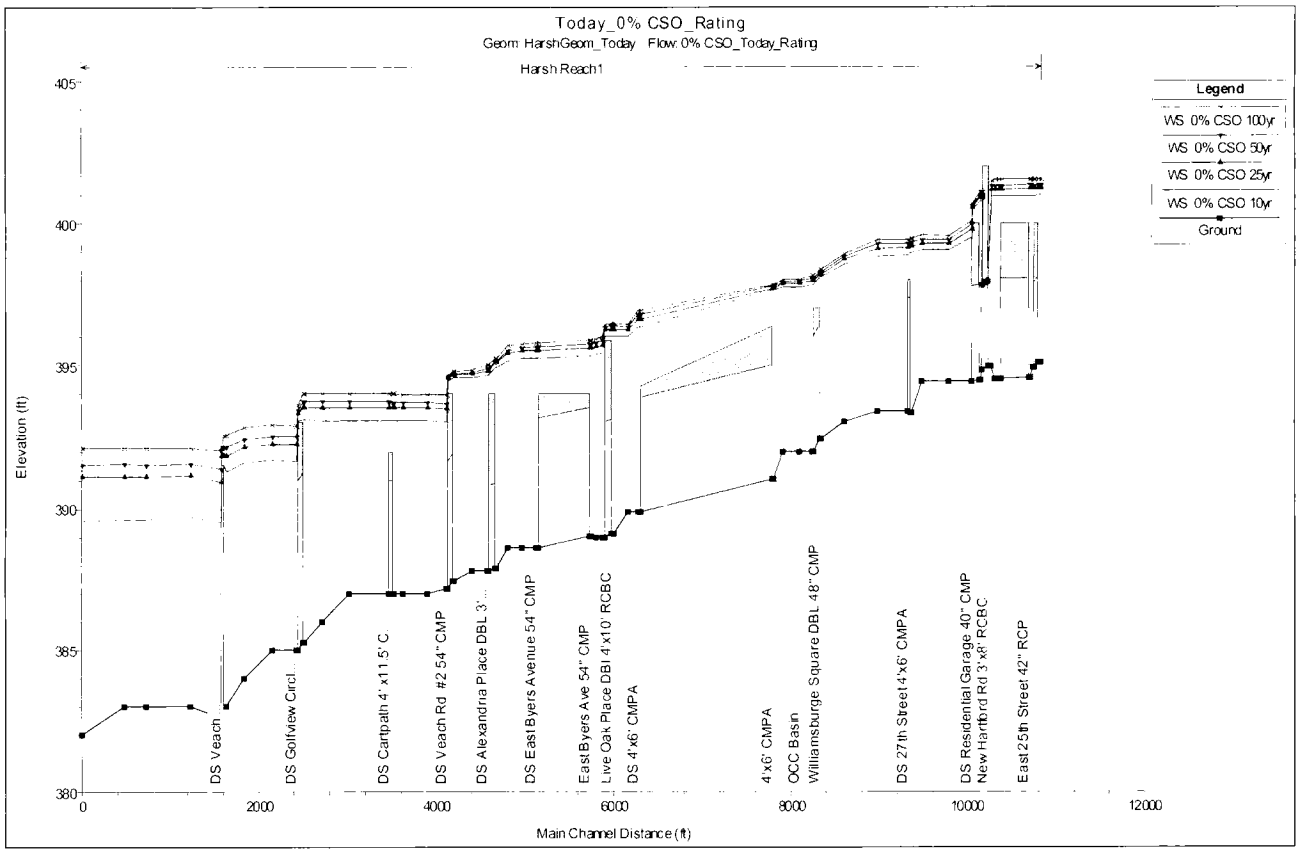


Figure 5 Existing Conditions Profile (0% CSA)

Proposed Improvements Model

Due to the low runoff velocities ubiquitous throughout the watershed it was necessary to increase the capacity of Harsh Ditch to convey the flow. The proposed improvements model is representative of how Harsh Ditch will function with increases in channel size, drainage structure size and construction of inline retention areas. The proposed structure improvements are shown in Table 8 and the proposed retention basins are shown in Table 9. Figures 6 and 7 show the water surface profiles for the proposed improvements model which will accept an additional 2% or fifteen (15) acres of the combination sewer area with and without backwater conditions respectively.

Table 8
Proposed Structure Improvements

	EXISITNG			PROPOSED		
Location	**Quantity**	**Type**	**Length (ft)**	**Quantity**	**Type**	**Length (ft)**
Parking Lot Entrance	Single	4x3 CMPA	56	TO REMAIN		
East 25th Street	Single	42" RCP	323	TO REMAIN		
New Hartford Road	Single	8x3 RCBC	80	Double	8x3 RCBC	80
Residential Garage	Single	40" CMP	86	TO BE REMOVED		
East 27th Street	Single	6x4 CMPA	27	Single	12x6 RCBC	36
Ridgeway Drive	Double	48" CMP	72	Double	10x4RCBC	233
Canterbury Rd.	Single	6x4 CMPA	1495	Double	10x4RCBC	1209
Parkway Drive	CURRENTLY OPEN CHANNEL			Double	10x4RCBC	197
Live Oak Place	Double	10x4 RCBC	73	TO REMAIN		
East Byers Avenue	Single	54" CMP	580	Double	4x10 RCBC	1618
Alexandria Place	Double	5x3 CMPA	80			
Veach Road #2	Single	54" CMP	60			
Owensboro CC Cart Path	Single	4x11.5 CMPA	34	TO REMAIN		
Golfview Circle	Double	72" CMP	52	Double	10x6 RCBC	60
				Single	8x6 RCBC	60
Veach Rd #1	Single	13x8 RCBC	25	Double	10x6 RCBC	43
				Single	8x6 RCBC	43

Table 9
Proposed Retention Basins

Description	Retention Volume (ac-ft)
Fiddlesticks Basin	18.05
Parkway Drive Basin	2.69
Owensboro Christian Church Basin	8.22
North Williamsburg Square Basin	33.83

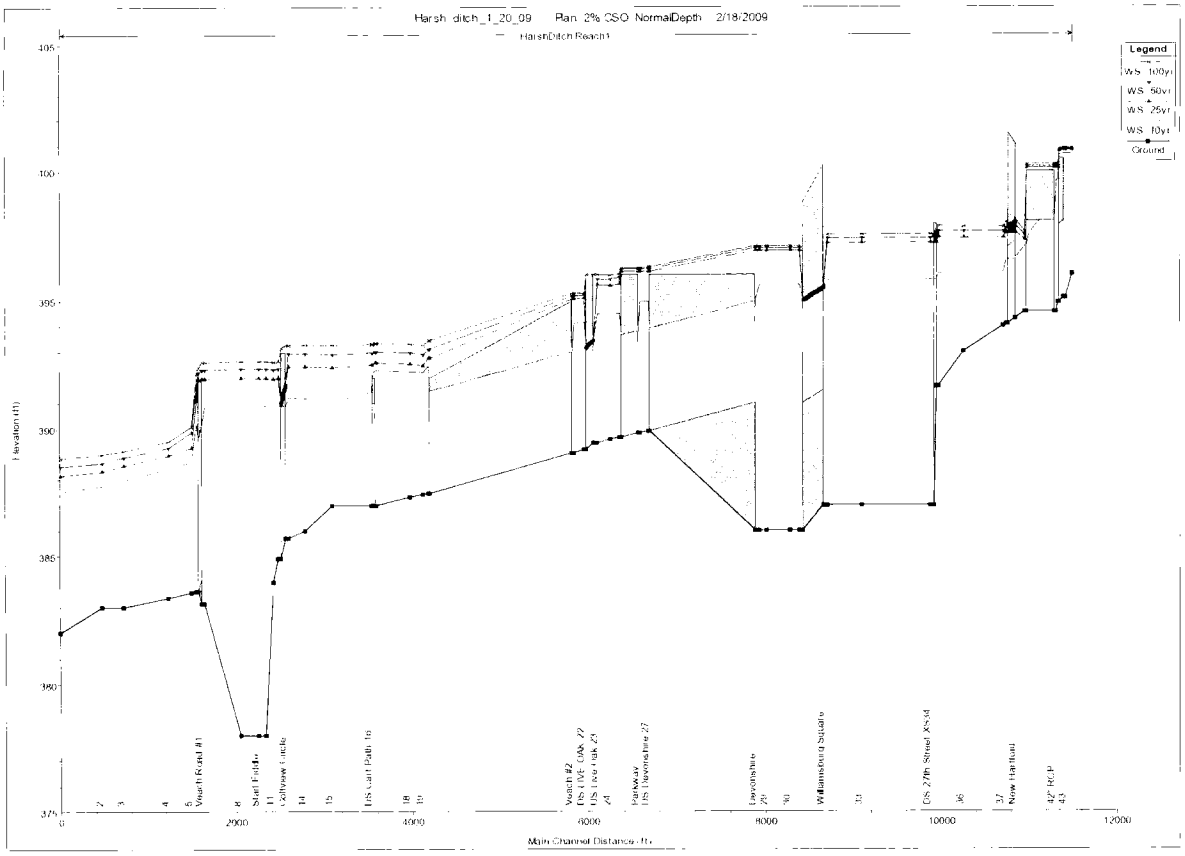


Figure 6 Proposed Improvements Profile (0% CSA) without backwater

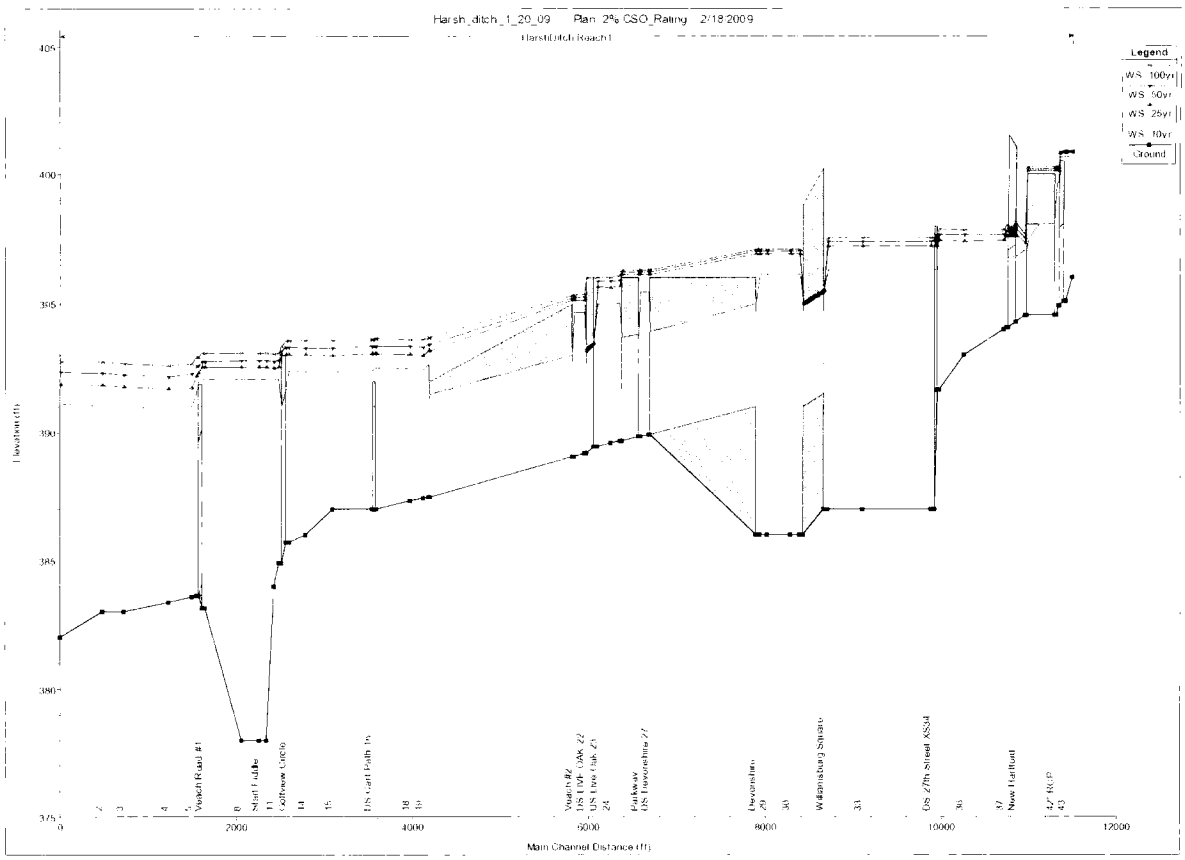


Figure 7 Proposed Improvements Profile (0% CSA) with backwater

Table 10 is a comparison of water surface elevations between Harsh Ditch as it functions today and as it will function with proposed improvements and runoff contribution from additional combination sewer area. The table gives elevations at lettered cross sections determined in the published 1997 FIS for both backwater and without backwater scenarios. It can be seen that the proposed improvements will decrease the water surface elevation throughout Harsh Ditch with the exception of the most downstream cross sections. The increased water surface elevations can be attributed to a more efficient conveyance system which channelizes previously unchannelized runoff that collected in localized depressions and routes it downstream.

The engineer emphasizes that this project is an initial step taken by the City of Owensboro to alleviate flooding and that future improvements to the Harsh Ditch drainage system will be necessary to reduce water surface elevations downstream. The goal of this project as mentioned earlier is to construct a main storm-water conveyance system that can be added to in the future. Future storm water improvement projects planned for Harsh Ditch are additional storm water retention basins and enlargement of portions of the upstream channel and hydraulic structures.

Table 10
Existing Conditions Model Compared To Proposed Improvements Model

Cross Section	Existing Regulatory[1] 0% CSO Without Improvements (FEET NAVD)	Proposed Regulatory[1] 2% CSO (FEET NAVD)	Diff. (FEET)	Existing Without Floodway[2] 0% CSO Without Improvements (FEET NAVD)	Proposed Without Floodway[2] 2% CSO (FEET NAVD)	Diff. (FEET)
Harsh Ditch						
B*	392.1	392.8	+0.7	388.9	389.0	+0.9
C	392.6	393.1	+0.5	392.1	392.6	+0.5
D	392.6	393.1	+0.5	392.1	392.6	+0.5
E	392.9	393.1	+0.2	392.6	393.3	+0.3
F	394.0	393.6	-0.4	393.9	393.3	-0.6
G	394.0	393.6	-0.4	393.9	393.3	-0.6
H	394.0	393.6	-0.4	393.9	393.3	-0.6
I	394.0	393.6	-0.4	393.9	393.3	-0.6
J	394.0	393.6	-0.4	393.9	393.3	-0.6
K	394.0	393.6	-0.4	393.9	393.3	-0.6
L	394.8	393.8	-1.0	394.8	393.6	-1.2
M	395.7	395.3	-0.4	395.7	395.3	-0.4
N	396.0	395.3	-0.7	396.0	395.3	-0.7
O	396.4	396.0	-0.4	396.4	396.3	-0.1
P	398.0	397.1	-0.9	398.0	397.1	-0.9
Q	398.2	397.1	-1.1	398.1	397.1	-1.0
R	398.9	397.6	-1.3	398.3	397.6	-0.7
S	399.4	397.6	-1.8	399.4	397.6	-1.8

[1]With Backwater

[2]Without Backwater

*Locations with water surface increase greater than 0.5ft

Conclusion

The proposed drainage improvements for Harsh Ditch will significantly reduce the standing water in the streets and provide additional protection to homes and businesses for storm events at or less than the 25yr event. Although the removal of all standing water in the streets will not be accomplished by this project the depth of water in the streets will be greatly diminished and allow passage of emergency vehicles during the 25yr event. In addition to the reduction of flood elevations this project will allow additional storm-water currently entering the combination sewer system to be redirected to Harsh Ditch, thus decreasing the amount of influent to the wastewater treatment plant.

ARMY CORPS OF ENGINEERS
PERMIT APPLICATION

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT (33 CFR 325)	OMB APPROVAL NO. 0710-003

Public reporting burden for this collection of information is estimated to average 5 hours per response, including the time for reviewing instructions, Searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Service Directorate of Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302; and to the Office of Management and Budget, Paperwork Reduction Project (0710-003), Washington, DC 20503. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authority: 33 USC 401, Section 10; 1413, Section 404. Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the United States; the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME & TITLE (an agent is not required)
City of Owensboro / Joe Schepers, PE City Eng.	R. David Weaver, PE; Project Manager
6. APPLICANT'S ADDRESS P.O. Box 10003 Owensboro, KY 42302-9003	9. AGENT'S ADDRESS Bryant Engineering, Inc. / 4156 Benttree Drive Owensboro, KY 42301
7. APPLICANT'S PHONE NUMBERS WITH AREA CODE a. Residence b. Business 270-687-8646	10. AGENT'S PHONE NUMBERS WITH AREA CODE a. Residence 270-316-7235 b. Business 270-685-2811

11. STATEMENT OF AUTHORIZATION

I hereby authorize R. David Weaver, PE, PLS to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

APPLICANT'S SIGNATURE _____ DATE _____

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

Harsh Ditch, Phase II

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
Harsh Ditch	From the lower Veach Road crossing downstream to the US 2155 crossing located in the City of Owensboro, KY
15. LOCATION OF PROJECT Daviess (COUNTY) KY (STATE)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

The project follows the existing alignment of Harsh Ditch and parallels Veach Road. In general the project is located in the southeastern quadrant of the City of Owensboro.

17. DIRECTIONS TO THE SITE

The project can be accessed by taking the north bound exit ramp from the US 60 Bypass onto KY 2155 and traveling north on KY 2155 to the intersection of KY 2155 and E 25th. Turn left onto E 25th Street and left onto Veach Road.

18. NATURE OF ACTIVITY (Description of project, include all features)

In general the project will provide drainage improvements to Harsh Ditch from the lower crossing of Veach Road to the KY 2155 crossing. A more detail listing is provided on the attached sheet labeled "#18 NATURE OF ACTIVITY".

19. PROJECT PURPOSE (Describe the reason or purpose of the project, see instructions)

The project has two primary goals:
1.) To lessen the impacts of flooding in the project area. 2.) To improve the drainage system to allow for future combined sewer seperation projects.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. REASON(S) FOR DISCHARGE

N/A

21. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS

N/A

22. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (see instructions)

N/A

23. IS ANY PORTION OF THE WORK ALREADY COMPLETE? YES ○ NO ◉ IF YES, DESCRIBE THE WORK

24. ADDRESSES OF ADJOINING PROPERTY OWNERS, LESSEES, ETC. WHOSE PROPERTY ADJOINS THE WATERBODY (If more than can be entered here, please attach a supplemental list)

Note attached sheet labeled "#24 ADJOINERS".

25. LIST OF OTHER CERTIFICATIONS OR APPROVALS/DENIALS RECEIVED FROM OTHER FEDERAL, STATE, OR LOCAL AGENCIES FOR WORK DESCRIBED IN THIS APPLICATION

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
KY Division of Water 401 Water Quality			Permit to be submitted		

* Would include but is not restricted to zoning, building and flood plain permits.

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.
18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and will fully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, facticious, or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

BRYANT ENGINEERING INC.
ENGINEERING • LAND SURVEYING
4215 Pentree Drive
P.O. Box 21382
Owensboro, Kentucky 42304
Office: 270-685-2811
Fax: 270-683-4991

TRANSMITTAL

Date: 02/26/09

Project Number: 07-3968

RE: Harsh Ditch, Phase II
City of Owensboro

To: Joel Murphy
Kentucky Division of Water
14 Reilly Road
Frankfort, KY 40601
Ph: 502-564-6716

Qty	Description
1	Stream Encroachment Permit

Remarks:

Signed: R. David Weaver, PE, PLS

CC: Joe Schepers, PE, SE
Jim Mischel